JOURNAL
OF THE
WASHINGTON ACADEMY OF SCIENCES

VOLUME 34 OCTOBER 15, 1944 No. 10

ANTHROPOLOGY.—*Filed Indian teeth from Illinois.*[1]

T. D. STEWART, U. S. National Museum, and P. F. TITTERINGTON, St. Louis, Mo.

Evidence that tooth mutilation was practiced by the American Indians has been found mainly in parts of Middle America and in Ecuador in South America. Inlay was practiced in both of these areas, but filing seems to have been restricted chiefly to Middle America (Linné, 1940). With the importation of Negroes in historic times the African custom of chipping the teeth was superimposed to some extent upon the native practice and certainly was introduced into parts of Middle and South America formerly free from any form of dental mutilation (Stewart, 1942).

North of Mexico there has been heretofore no very certain evidence for, and much negative evidence against, the existence of the custom. Although thousands of skulls from North America have been the subject of general study, only one, so far as we can discover, has been described in print as having filed teeth. This exceptional specimen is from the Pueblo region of Arizona. The description of it is contained in a footnote in which Saville (1913, p. 378) defends a statement attributed to him by Lasch (1901) to the effect that the custom could be traced from the Pueblo region to southern Central America: "Regarding the Pueblo region, I made the statement after having photographed a skull found by Dr. Fewkes at Sikyatki, Arizona, a study of which seems to me clearly to indicate single serrations in at least three of the upper incisors and in the lower right lateral incisor." Unfortunately, Saville did not reproduce the photograph of these teeth, and it cannot now be located. The skull, catalogued in the U. S. National Museum as no. 156319,[2] in the meantime has been sent in exchange to the Museum of South Australia. For the present, therefore, all that can be said is that Saville's description of the mutilation pattern in this specimen is too vague to permit identification with any of those from Middle America with which we are familiar.

In spite of this seeming rarity of dental mutilation in North America, many anthropologists probably will not be surprised to learn that undoubted examples now have been found in the Mississippi Valley, because they have become increasingly aware of indications of late prehistoric contact between our Southeast and Mexico (cf. Phillips, 1940). The new specimens are four in number and come from a small area within a radius of 40 miles of St. Louis, Mo. These specimens will be described not in the order of their recovery but in the order in which the mutilation was recognized.

DESCRIPTION

Jersey County bluff skeleton.—The first specimen was excavated by one of us (P. F. T.) in 1935 in a Jersey County bluff mound located 18 miles above the mouth of the Illinois River and designated as number 12 (Titterington, 1935; fig. on p. 11 and pl. 1, fig. 1). The skeleton, being the fifth encountered in this mound,[3] was designated Jy°12-5. It was discovered extended on the back at a depth of 2 feet, and 4½ feet from

[1] Published by permission of the Secretary of the Smithsonian Institution. Received June 9, 1944.

[2] The identification of the skull is based on a note made by Hrdlička years ago when he measured it. "Filing of all incisors."

[3] A disturbed area contained fragmentary bones of at least three additional individuals.

the north end of the mound. No artifacts accompanied this burial, but mussel shell spoons, bone awls (split tibia of deer, leg bone of turkey), and a corner notched white flint knife were found with the other burials. From the time of excavation until the dental mutilation was recognized recently by one of us (T. D. S.) there seemed to be nothing, except perhaps burial position and light bone color, to distinguish this individual from others of the same and adjacent mounds. Extended burials are rather uncommon in these mounds, having been observed in only 5 per cent of 852 burials (Titterington, 1943). Curiously, all but one of the five burials in mound 12 were found lying on the back or side, either fully extended or with the knees slightly flexed. The lighter color and perhaps softer texture of skeleton no. 5 are of doubtful significance and under ordinary circumstances would not have merited attention; they are such as are sometimes seen resulting from peculiarities in soil and drainage.

This individual is a male and about 25 years of age. The age can be fixed fairly closely by the fact that the epiphyses of the iliac crest and ischial tuberosity are united, whereas the proximal epiphysis of the clavicle is still ununited. Also, the symphysis shows the characteristic billowing of this age.

The tooth mutilation exhibited by this young male (Fig. 1, A) consists of six A-shaped grooves or notches: two in the occlusal edge of each upper median incisor and one in each upper lateral incisor. The remaining upper teeth and all the lower teeth are not involved. The notches are not very deep but originally may have been deeper because about a millimeter of the occlusal edge has disappeared through attrition.

In most skull measurements no. 5 is above the average of the Jersey County bluff group, and yet well within the group range (57 males). The group as a whole, including this specimen, is rather low in variability. The ratios between the skull measurements, likewise within the group range, are reasonably close to the group averages, as shown by the following figures:

Index	*No. 5*	*Male Average*	*Range*
Cranial	77.7	75.5 (57)	69.6– 81.6
Mean height	89.9	88.5 (55)	82.0– 95.5
Upper facial	52.8	54.2 (55)	46.4– 61.9
Orbital	94.9	87.7 (57)	72.5– 98.6
Nasal	47.2	49.1 (57)	42.4– 56.9
External alv.	130.2	122.5 (46)	110.2–134.0

The fact that no. 5 has a rounder orbit and shorter palate is probably not significant in the sense of a true group difference.

Cahokia isolated tooth.—The single median incisor next to be described (Fig. 1, F, G) was picked up either by P. F. Titterington or by the late M. A. Wurtheimer in October, 1925, on the surface of a village site three-fourths of a mile west of Monk's Mound (Cahokia) in East St. Louis, Ill. When we examined this tooth together in 1943, but before the mutilation in the foregoing specimen was recognized, we did not appreciate its full significance. It was difficult at that time to make the correct interpretation owing to several factors that will be described. Much of the enamel had been lost postmortem, and in addition there had been extensive antemortem wear of the occlusal edge. These alterations in the enamel so changed the appearance of the tooth that we were uncertain whether it was an incisor or canine, human or animal. Moreover, the nature of the markings on the remaining enamel surface also influenced our opinion. These consisted of a transverse groove on the labial surface and four A-shaped notches in the occlusal edge (the outermost notches being incomplete now due to loss of enamel). As far as we know, a transverse groove has not been described heretofore in the Western Hemisphere.[4] Thus we were inclined earlier, upon cursory examination, to regard the markings on this tooth as an example of postextractional decoration. This interpretation was dispelled upon subsequent study when we decided that the tooth is really a human upper median incisor and that the markings show a polishing that could have been acquired only during life.

Cahokia compound burial.—In January, 1944, one of us (P. F. T.) acquired some

[4] Dr. Gordon Willey tells us that a skull with a transverse groove on the labial surface of each median incisor was found in a Lamar culture site near Macon, Ga. Efforts to secure this skull for examination have been unsuccessful thus far.

loose human teeth from two men, Joe Walta and Gregory Perino, who in the fall of 1943 had found a compound burial, at a depth of 3 feet, several hundred yards east of Monk's Mound. The skeletal material is said to have been in poor condition and only the better preserved teeth from a few of the skulls were saved. Upon cleaning these teeth notches were observed in three, but no significance was attached thereto by the discoverers. The only recovered cultural object associated with this burial is a small, rough, 3-notched arrowhead.

The three filed teeth—upper median incisors and upper right lateral incisor—were found upon close examination to have large facets of wear resulting from the rubbing together of the teeth at the points of their proximal contact. From the appearance of these facets it was possible to reestablish the original relationships of all three teeth (Fig. 1, D, E), and to demonstrate that they belonged to one individual. In the same way an unfiled right upper canine was found to articulate with the lateral incisor. No other teeth belonging to this individual could be definitely identified. As thus revealed, the mutilation pattern consists of three A-shaped notches in the occlusal edge of each upper median incisor and two in each (probably) lateral incisor. The notches are very shallow and involve only the enamel of the labial surface. Wear of the occlusal edge has reached the point of dentin exposure and is irregular owing to a slight malocclusion (rotation of median incisors). These facts suggest that the filing was done after attrition was well under way.

Grindell skull.—The last example of filed teeth, which has come to our attention since the first of the year, was obtained by one of us (P. F. T.) from the collection of J. C. Grindell. In this case the whole skull was recovered and is known to be part of an extended burial, one of some 16, exposed in 1937 by Gregory Perino at the base of a bluff 8 miles south of the Cahokia Mound group. The scanty cultural material found in association with these burials (barrel-shaped shell beads, cord-impressed grit-tempered sherd) are not diagnostic as to period.

The sex of this individual can not be determined with certainty from the skull alone. Supraorbital ridges are almost completely absent, the orbital margins are sharp, and the occiput lacks muscle ridges—all female characters. On the other hand, the lower jaw is well developed and has a square chin, as in a male. The sutures of the vault are still open and the teeth are only moderately worn. This indicates an early adult age period.

The dental mutilation consists of three small A-shaped notches in the occlusal edge of each upper medial incisor (Fig. 1, B, C). The other teeth are not involved. Of the three notches on each of the two mutilated teeth, the one farthest to the right is largest and most distinct. As in the preceding cases only the labial surface of the enamel is involved.

An indication of the physical type of this skull may be gained from the following indices derived from the cranial measurements and compared with the Jersey County bluff females:

Index	*Grindell skull*	*Female average*	*Range*
Cranial	79.9	75.9 (52)	69.9– 84.3
Mean height	84.3	88.7 (49)	83.2– 94.7
Upper facial	56.1	55.5 (47)	48.5– 61.4
Orbital	92.1	89.1 (51)	80.0– 98.6
Nasal	46.9	51.0 (52)	43.1– 60.9
External alv.	118.2	118.7 (36)	105.6–132.6

DISCUSSION

The four examples of tooth filing from Illinois here reported, together with the two other cases about which we have indirect knowledge—from Arizona and Georgia—have one thing in common: a late prehistoric age. The specimens from near St. Louis most probably relate to the Middle Mississippi cultural period, "the last phase of the pre-Columbian history of the Mississippi Valley, say roughly the interval between 1400 and 1700 A.D." (Phillips, 1940, p. 365). In general the Cahokia mound site belongs to this period, whereas the Jersey County bluff focus exhibits about equal numbers of Woodland and Middle Mississippi cultural traits (see McKern's allocation in Titterington, 1943). The specimen reported to have been found near

Macon, Ga., is attributed to the Lamar period of which Ford and Willey (1941, p. 351) say: "This was probably well formed and had taken over the southeastern area, submerging the earlier Middle Mississippi culture, by 1600." Similarly, Sikyatki in northern Arizona, while not yet accurately dated, is generally regarded as belonging to the Pueblo IV period, which extended from about 1250 to 1700 (Roberts, 1937).

As already indicated, evidence has been accumulating that certain cultural traits attributed to the Middle Mississippi period seem to have been derived more or less directly from Mexico (Phillips, 1940). Since tooth mutilation is a good Middle American trait, the finding in Illinois of the first specimen described above suggested to one of us (T. D. S.) that here was an actual bearer of this culture. How otherwise than by visiting a place where tooth mutilation was practiced could an Indian in these early times have learned about and had his own teeth filed? From this assumption it seemed logical to conclude that, since this individual was of the same physical type as the Jersey County bluff people among whom he was buried, he must have been a local Indian who had traveled as far south at least as Mexico.

The subsequent finding of three more examples of tooth mutilation nearby changes this picture and indicates the danger in generalizing from insufficient information. It now seems possible that the custom was even more common and perhaps widespread in our country than we have detected. This being the case, we can not say that any one of these individuals bore the custom in his own teeth from Middle America, and it is more unlikely that all had made the trip.

That there can be little doubt as to Mexico or Central America being the source from which our Indians derived the custom is shown by the details of the mutilation. The same pattern of notches as exhibited by the Jersey County bluff specimen (1-2-2-1; or according to Rubín de la Borbolla's classification: A-C-C-A) has been illustrated by Rubín de la Borbolla (1940, pl. 1c), Strebel (1885, pl. 8, no. 18), and Stewart (1941, pl. 1, D) with specimens from Mexico (States of Michoacán and Veracruz) and Honduras, respectively. Quite likely a thorough search of the literature would reveal still other such illustrations, for, judged from descriptions of isolated teeth, this pattern seems to have been used quite frequently.

Teeth with three notches are also well known from Middle America (Rubín de la Borbolla, 1940) but their arrangement in patterns, such as that exhibited by the second Cahokia specimen (2-3-3-2, or C-D-D-C), does not seem to have been described.

The first Cahokia specimen, which is an isolated tooth, and also the reported Lamar specimen (see footnote 4), exhibit pattern elements that appear to be new. In Borbolla's summary of dental mutilations neither four notches in a single tooth nor a transverse groove is mentioned. This may indicate that the custom had already been present in this country long enough to have acquired variations. On the other hand it may mean merely that distance and a new setting had released the original custom from its habitual limitations.

It is hoped that this report will stimulate others in possession of cranial collections from Middle Mississippi sites to look for further examples of this trait.

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Fig. 1.—Four cases of filed Indian teeth from Illinois: A, Jersey County bluff skull; B and C, Grindell skull; D and E, Cahokia compound burial; F and G, Cahokia isolated tooth. Except for the first specimen, both labial and lingual views are given. Slightly enlarged.

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ANTHROPOLOGY.—*The dental condition of a skull from the Sikyatki site, Arizona.*[1] T. D. CAMPBELL, South Australian Museum. (Communicated by T. D. STEWART.)

The deformed male skull, the teeth of which here are being described, is unique, inasmuch as it is the only known example of artificial tooth mutilation from the southwestern part of the United States. This specimen, from the Pueblo region of Arizona (Sikyatki site), reached the South Australian Museum through exchange with the U. S. National Museum in 1931, and bears the latter's no. 156319.

General.—Upper jaw and mandible intact.

Teeth present: $\frac{87654321|1234567.}{87654321|1234567.}$

The upper left third molar appears either to have been lost for some time or never to have erupted (no X-ray confirmation made of this). The lower left third molar has been lost postmortem, the socket being quite apparent.

Many of the teeth in both arches have lost a portion of their crown enamel, which has chipped off postmortem. In the upper first and second molars on both sides, this condition is fairly marked. The three lower right molars also have lost appreciable amounts of their enamel. Upper and lower incisors have been similarly affected.

Caries.—The only teeth present showing any indication of dental caries are $\frac{|6}{7|}$ which present very small (pinhead) cavities on the cervical region of their distal enamel surface.

[1] Received August 1, 1944.

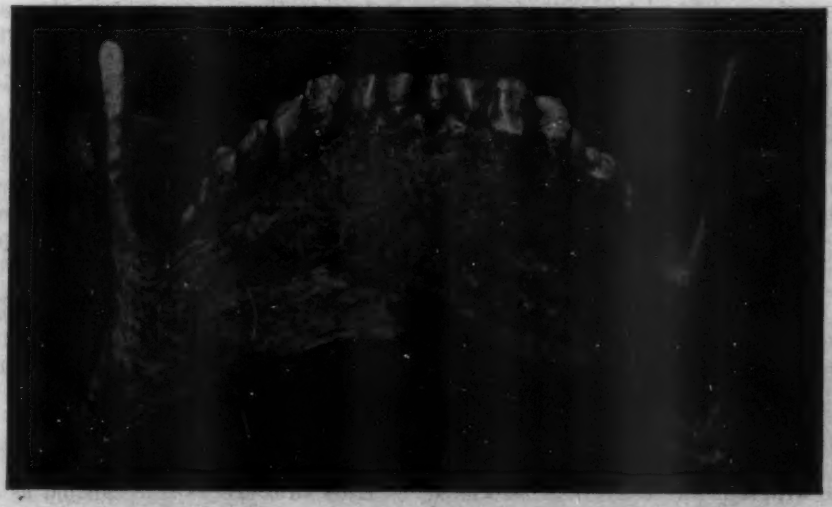

Fig. 1.—Anterior view of mandible showing obvious filing on $\overline{21|}$; slight filing on $|\overline{2}$; not apparent on $|\overline{1}$.

Attrition.—Practically all the teeth present, except the third molars, show definite wear of the occlusal surface. Most of them approximate stage II (Broca), that is, show sufficient wear of enamel to expose the cuspal eminences of the dentine. This condition of wear also definitely includes the incisors and cuspids, both upper and lower.

Alveolar process margins.—There appears to have been some minor degree of absorption of the peridental alveolar crest during life; but in places further loss has taken place postmortem.

Filing of teeth.—This artificially made condition involves both upper and lower four incisors. Without other specimens with this form of mutilation for comparison, it is suggested that the filing has not been carried out to any appreciable depth unless attrition has reduced the original effect.

In the case of the upper incisors the filed condition is obliterated to some extent on $\frac{21|1}{|}$ by postmortem loss of the labial surface enamel. It is considered so much so that a photograph of these upper teeth would be useless. In general, it may be said that the depth of filing in the form of a small narrow V-shaped notch (formed by labiolingual filing across the incisal edge) on all the incisors is, at the most, not more than 1 mm in depth. The file notches are evident only on the labial and lingual enamel, as the incisal edges have been worn to flat surfaces with exposed dentine showing inside the ring of enamel. This latter point suggests that possibly the filing was done well before adulthood, or before attrition had obliterated the incisal edges of the teeth concerned. If this be so, the V notch was probably much deeper than seen on this specimen. Other examples should confirm this, or otherwise.

The dental condition of this specimen does not present any other features of special interest requiring description for present purposes.

Fig. 1 shows an anterior view of the mandible. Filing is quite obvious on $\overline{21}|$; very slight on $\lceil\overline{2}$; on $\lceil\overline{1}$ not apparent.

BOTANY.—*Descriptions and revisions of several species of viruses in the genera* Marmor, Fractilinea, *and* Galla.[1] H. H. McKinney, Bureau of Plant Industry, Soils, and Agricultural Engineering.

Several species and varieties of viruses infecting cereal and forage grasses are herein described and named. The description of the wheat mosaic-rosette virus is emended. The description of the tobacco ring-spot virus is emended, and the species is transferred to the genus *Marmor* Holmes emend. McKinney (14). The virus inducing mild dark-green mosaic in tobacco is described and named.

The viruses infecting cereal grasses in Russia and Siberia are placed in the genus *Fractilinea* McKinney (14), because they induce chlorotic mottling and streaking reactions that are almost identical with the reactions induced by the grass-mosaic viruses, and they are transmitted by leafhoppers or by planthoppers. It is not entirely clear that the necrosis referred to by some writers in the U.S.S.R. is associated chiefly with the phloem as some writers state that there is necrosis in the parenchyma. The grass mosaics occurring in the U.S.S.R. seem to be sufficiently distinct in their transmission and other characteristics to justify specific ranks in each case.

The wheat-mosaic viruses reported from Japan seem to be very similar to the soil inhabiting wheat-mosaic viruses occurring east of the Mississippi River in the United States, and no attempt is made to separate them at present. The rosette expression has not been positively identified with the viruses occurring in Japan, but it is possible that none of the wheat varieties used in the Japanese tests carry genetic factors for the rosette expression.

The virus inducing the wallaby-ear disease of corn (maize) is placed in the genus *Galla* Holmes as redefined by McKinney (14).

Each virus species is designated as a binomial, and the description embraces only characteristics that are common to all the

[1] Received April 4, 1944.

recognized forms included under it. In all cases in which subdivisions of a species are recognized, the name var. *typicus* is given to the form on which the species was originally based or which is selected as the typical form in case the species as originally described included more than one form. This procedure is in accord with that followed by several students of the flowering plants, including Croizat (1) and Ley (6). The description of the species may require emendation from time to time as new strains and closely related species are described, as it is not possible to foretell what characters may differentiate undiscovered strains. All the strains described are accorded the rank of variety. All these have been isolated with comparative ease from diseased plants growing under field culture conditions. As further study may indicate that some of these strains, or possibly some of the species, should be placed at higher or at lower levels in the scheme, the changes may be made in accordance with the International Rules of Botanical Nomenclature.

Marmor tritici Holmes (2) emend.

Host reactions: In *Triticum aestivum* L. (*T. vulgare* Vill.), *T. compactum* Host, *T. turgidum* L., *T. durum* Desf., *T. spelta* L., *T. timopheevi* Zhuk., *T. dicoccum* Schrank, *T. polonicum* L., *T. monococcum* L., *Hordeum vulgare* L., *Secale cereale* L., and in *Bromus commutatus* Schrad., induces chlorotic streaking and mottling in varying degrees from slight to severe. Optimum experimental conditions for expression of disease reactions near 15.6° C. with a daily photoperiod near 8 hours. Induces vacuolar cell inclusions associated with cells of the epidermis, mesophyll and phloem parenchyma. *Agropyron repens* (L.) Beauv., *Bromus inermis* Leyss., *Avena sativa* L., *A. byzantina* C. Koch, *Zea mays* L., *Nicotiana tabacum* L., *Lycopersicon esculentum* Mill., *Cucumis sativus* L., and *Phaseolus vulgaris* L. are immune or highly resistant.

Transmission: By inoculation with expressed juice, using needle pricks in the bases of small seedlings or by the carborundum-wiping method, but with difficulty. In nature virus overseasons in soil, more especially soils of heavy texture; natural infection in fall-grown winter annuals and in certain fall-sown spring annuals that survive mild winters. Infection rare in spring-sown suscepts and in winter wheats that emerge in spring when sown very late in autumn.

Insect vector not known, but some soil inhabiting vector is suspected, as no infection has occurred in plants grown in sterilized soil to which was added ample quantities of virus-infested plant tissue. Wheat plants grown in sterilized soil in containers located in infested areas during the entire natural growing season have never developed mosaic.

Mutation: Mutation has not been proved, but it is suspected. However, it appears that interference (antagonism) between the type virus and its presumed strains is of a low order as the strains have been isolated by methods that would fail to isolate the mutants of other viruses that manifest a high degree of unilateral interference.

Physical properties: Inactivated in 6 to 14 days at room temperatures in leaf tissue collected fresh, clipped in short pieces and allowed to dry. Heavily infested soil was rendered noninfectious when drenched with a solution of 1 part formalin in 49 parts of water, also when heated in a moist condition for 10 minutes at temperatures near 60° C. and above; when diluted with 31 parts of noninfectious soil, infection in wheat was reduced from 98 percent in the control to 5.3 percent.

Marmor tritici var. typicum, var. nov.

Wheat virus 1 McKinney (10); Triticum virus 1 Smith (20); *Marmor tritici* Holmes (2).

Common name: Wheat mosaic-rosette virus.

Host reactions: In *Triticum aestivum* var. Harvest Queen and a few other varieties of winter wheat, virus induces mild green mosaic, bud proliferation, rosetting, and dwarfing; in most varieties of *T. aestivum* and in other suscepts, induces mosaic ranging from mild green to severe yellow types.

It has not been possible to maintain this virus indefinitely in manually inoculated wheat plants cultured under apparently optimum conditions in chambers. The infection rate has gradually decreased until none obtained, and it became necessary to make new isolations from time to time from naturally infected plants in the field.

Distribution: Illinois, Indiana, Maryland, Virginia, North Carolina; possibly Japan.

Marmor tritici var. fulvum, var. nov.

Wheat virus 3 McKinney (10).

Common name: Prairie wheat yellow-mosaic virus.

Varietal name from L., *fulvus*, deep yellow.

Host reactions: In *Triticum aestivum* var. Harvest Queen and in other suscepts, induces yellowish-green to yellow mosaic; severe stunting, leaf rolling, and death in highly susceptible hosts, but no systemic necrosis or rosette.

It has not been possible to maintain this virus indefinitely in manually inoculated wheat plants cultured under apparently optimum conditions in chambers. The infection rate has gradually decreased until none obtained, and it became necessary to make new isolations from time to time from plants infected in the field.

Distribution: Illinois, Indiana, Maryland, Virginia, North Carolina; possibly Japan.

References to literature: (2, 3, 4, 8, 9, 10, 15, 20, 28, 29, 30, 31, 32).

Marmor campestre, sp. nov.

Specific name from Latin, *campester*, adj., dwelling on open plains.

Host reactions: In *Triticum aestivum* L., *T. spelta* L., *T. timopheevi* Zhuk., and in *Hordeum vulgare* L., induces chlorotic mottling and streaking; no proliferation or rosetting. Optimum conditions for expression of disease reactions near 15.6° C. with a daily photoperiod near 8 hours, induces vesicular cell inclusions. *Avena sativa* L., *Bromus inermis* Leyss., *Agropyron repens* (L.) Beauv., *Zea mays* L., *Nicotiana tabacum* L., *Lycopersicon esculentum* Mill., *Cucumis sativus* L., and *Phaseolus vulgaris* L., are immune or highly resistant.

Transmission: By inoculation with expressed juice, using needle pricks in the bases of small seedlings or by the carborundum-wiping method, but with difficulty; overseasoning in soil not known; no insect vectors known.

Mutation: Mutation has not been proved, but it is suspected. However, it appears that interference (antagonism) between the type virus and its presumed strains is of a low order as the strains have been isolated by methods that would fail to isolate the mutants of other viruses that manifest a high degree of interference.

Physical properties: Inactivated in about 7 months in leaf tissue at temperatures near −17° C.

Marmor campestre var. typicum, var. nov.

Wheat virus 4 McKinney (10).

Common name: Plain's wheat green-mosaic virus.

Host reactions: In *Triticum aestivum* vars. Harvest Queen and Turkey, induces light-green mosaic and stunting.

It has not been possible to maintain this virus indefinitely in manually inoculated wheat plants cultured under apparently optimum conditions in chambers. The infection rate has gradually decreased until no infection occurred, and it became necessary to make new isolations from time to time from plants infected in the field.

Distribution: Riley County, Kansas.

Marmor campestre var. galbinum, var. nov.

Wheat virus 5 McKinney (10).

Common name: Plain's wheat yellow-mosaic virus.

Varietal name from Latin, *galbinus*, adj., yellowish green, yellowish.

Host reactions: In *Triticum aestivum* vars. Harvest Queen and Turkey, induces severe yellow mosaic, sometimes yellow streaking, stunting, and sometimes killing.

This virus has been maintained in manually inoculated plants without difficulty under optimum conditions, but not under the high-temperature conditions obtaining during the summer period.

Distribution: Riley County, Kansas.

Reference to literature: (10).

Marmor virgatum, sp. nov.

Specific name from Latin, *virgatus*, adj., striped.

Host reactions: In *Triticum aestivum* L., *T. timopheevi* Zhuk., *T. turgidum* L., *T. durum* Desf., *T. spelta* L., *T. dicoccum* Schrank, *T. polonicum* L., *T. monococcum* L., *Hordeum vulgare* L., *Avena byzantina* C. Koch, *A. sativa* L., *A. sativa* var. *orientalis* (Schreb.) Alef., *A. brevis* Roth, *A. strigosa* Schreb., and *Zea mays* L., induces chlorotic mottling and streaking (con-

tinuous and broken); dwarfing of plant, but not necrosis, proliferation, or rosetting; induces vesicular cell inclusions. Disease reactions expressed over a relatively wide range of temperatures, from 15.6° C. to summer temperatures, apparently depending largely on the optimum requirements for the hosts. In *Zea mays* var. Golden Giant sugar, the incubation period ranges from 6 to 22 days; infection has not occurred in more than 50 percent of the seedlings when the best known methods were used, i.e., young seedlings inoculated before the third leaf exceeds 2.5 cm in length, with fresh virus obtained from young infected wheat leaves.

Agropyron repens (L.) Beauv., *Poa pratensis* L., *P. compressa* L., *Bromus inermis* Leyss., *Secale cereale* L., *Nicotiana tabacum* L., *Cucumis sativus* L., and *Phaseolus vulgaris* L., are either immune or very resistant.

Transmission: By inoculation with expressed juice, readily in most hosts by wiping carborundum dusted leaves of young seedlings, but difficult in *Zea mays;* overseasoning in soil null; insect vectors not known.

Physical properties: Inactivated in plant juice near 55° C. in 10 minutes; after about 7 months in tissue frozen near −17° C. in dry tissue after 34 to 40 days at room temperature; dilution-end-point near 5,000×.

Marmor virgatum var. typicum, var. nov.

Wheat virus 7 McKinney (10).

Common name: Wheat yellow streak-mosaic.

Host reaction: In *Triticum aestivum* var. Harvest Queen and Turkey, induces yellow streaks, continuous or broken; especially severe in Victoria and White Tartar varieties of oats, and in Hard Federation and Kawvale varieties of wheat. Seems to be the predominating type in wheatfields infested with this species. This virus has been maintained in manually inoculated wheat plants cultured over a wide range of conditions.

Distribution: Saline and Riley Counties, Kansas.

Marmor virgatum var. viride, var. nov.

Wheat virus 6 McKinney (10).

Common name: Wheat green streak-mosaic virus.

Varietal name from Latin, *viridis,* green.

Host reactions: In *Triticum aestivum* var. Harvest Queen and Turkey, induces light-green streaks, continuous or broken, and wide longitudinal bands; in Kawvale wheat symptoms are similar to those induced by var. *typicum,* therefore, this wheat is not a good differential host for the two viruses. In *Zea mays* var. Golden Giant sugar, the reactions are practically indistinguishable from those induced by var. *typicum.* The virus has been maintained in manually inoculated wheat plants cultured over a wide range of conditions.

Distribution: Saline and Riley Counties, Kansas.

Reference to literature: (10).

Marmor graminis, sp. nov.

Common name: Brome-mosaic virus.

Host reactions: In *Bromus inermis* Leyss., *Triticum aestivum* L., *Hordeum vulgare* L., *Secale cereale* L., *Avena sativa* L., var. *orientalis* Schreb., *A. byzantina* C. Koch, *Sorghum vulgare* Pers., *Euchlaena mexicana* Schrad., *E. perennis* Hitchc., *Zea mays* L., induces light-green to yellow mottling and streaking; no bud proliferation or rosetting. In *Euchlaena mexicana,* certain collections of *E. perennis,* and in *Zea mays,* induces local and systemic necrosis and death. In *Zea mays* var. Golden Giant sugar, the incubation period is from 36 to 40 hours for local lesions, and from 52 to 70 hours for systemic symptoms at high summer temperatures in the greenhouse. All seedlings become infected and die within a few days when inoculation is done by the best known methods. Increase of natural resistance with the aging of the corn plants is very marked. *Buchloë dactyloides* (Nutt.) Engelm., *Eragrostis curvula* (Schrad.) Nees., *E. trichodes* (Nutt.) Nash, and *Oryzopsis hymenoides* (Roem. and Schult.) Ricker, are "symptomless" carriers at temperatures near 21° C. during the winter. In *Phaseolus vulgaris* L., var. Scotia, virus induces small inconspicuous brown local lesions; in *Cucumis sativus* L., var. Early White Spine, and in *Nicotiana tabacum* L., var. Samsun(Turkish), induces local faintly chlorotic spots on the wiped cotyledons and leaves respectively, and there is a marked increase of virus in each host. This virus has a wide host range, especially among the grasses, and it is easily maintained in pure culture over a wide range of conditions.

Saccharum officinarum L., var. Louisiana

Purple, *Oryza sativa* L., and *Phaseolus lunatus* L., vars. Henderson Bush lima and Jackson Wonder lima are either immune or highly resistant.

Cellular pathology apparently unlike that induced by other viruses studied in cereal hosts. In unstained, living epidermal cells the inclusions are irregularly shaped, transparent, or translucent masses, usually located in the ends of the cells.

Transmission: By inoculation with expressed juice from diseased plants, readily by wiping on carborundum-dusted leaves of small seedlings; difficult in older plants.

Physical properties: Inactivated in 10 minutes at temperatures between 79 and 80° C. in juice from infected corn seedlings, after 12 months in dry leaves of *Bromus inermis* at room temperature; after 14 months at temperatures near −17° C. in juice from *B. inermis*. Dilution-end-point as high as 100,000 to 300,000 ×, using juice from *B. inermis* and diluting with distilled water.

Distribution: Manhattan, Kansas.

Reference to literature: (13).

Marmor agropyri, sp. nov.

Host reactions: In *Agropyron repens* (L.) Beauv. and in *Triticum aestivum* L., induces chlorotic mottling; no bud proliferation or rosetting. Optimum experimental conditions for expression of disease reactions near 15.6° C. with a daily photoperiod near 8 hours. Induces granular cell inclusions in epidermal cells occasionally.

Transmission: By inoculation with expressed juice, using needle pricks in bases of small seedlings or by the carborundum-wiping method, but with difficulty. Virus overwinters in the rhizomes.

Mutation: Suspected, but interference seems to be of a low order, if it occurs.

Marmor agropyri var. typicum, var. nov.

Wheat virus 2 McKinney (10).

Common name: Agropyron green-mosaic virus.

Host reactions: In *Agropyron repens* and *Triticum aestivum* var. Harvest Queen, induces mild-green mosaic that is masked during the summer.

Distribution: Arlington County, Virginia.

Marmor agropyri var. flavum, var. nov.

Common name: Agropyron yellow-mosaic virus.

Varietal name Latin, *flavus*, golden-yellow.

Host reactions: In *Agropyron repens* and *Triticum aestivum* var. Harvest Queen, induces yellow mosaic that is very mild during the summer, but not masked.

Distribution: Arlington County, Virginia. Coincident with var. *typicum*, but in separate colonies of the host.

Reference to literature: (10).

Marmor constans, sp. nov.

Tobacco virus 12 Johnson (5); Nicotiana virus 6 Smith (20).

Common Name: Tobacco mild dark-green mosaic virus.

Specific name from Latin, *constans*, adj., fixed, referring to the relatively stable nature of the virus with regard to mutation.

Host reactions: In *Nicotiana tabacum* L., var. Turkish (Samsun) and other commercial varieties of tobacco, induces chlorotic-mosaic mottling that tends towards a very coarse pattern; in *N. glauca* R. Grah. (Canary Isl. Col.) pronounced chlorotic mosaic mottling. In *N. glutinosa* L., *N. rustica* L., *N. sylvestris* Spegaz. Comes induces local necrotic lesions when cultured near 22° C. In *Phaseolus vulgaris* L. var. Scotia, induces small inconspicuous local necrotic lesions when cultured near 33.3° C. In certain collections of *N. tabacum* from Colombia (derivatives from Ambalema and T.I. 448A), induces only occasional chlorotic spots or no visible reactions, this resistance coinciding with that against *Marmor tabaci* (Holmes ex Valleau) McKinney. *Lycopersicon esculentum* Mill., and *Cucumis sativus* L. are immune. Interference (antagonism) between *M. constans* and *M. tabaci* ranges from very low or none to moderate, depending on the host and culture conditions.

Transmission: Readily by inoculation with expressed juice; insect vectors not known.

Mutation: No positive mutation has been observed in the hundreds of infected plants studied in the greenhouse, but isolates from *N. glauca* growing in the Canary Islands revealed what appears to be a closely related yellow type.

Physical and chemical properties: Inactivated

near 86° C. in 10 minutes in plant juices; activity not lost completely after 12 years' storage of dry tissue at room temperatures; dilution end point near 100,000 ×; the unit paracrystals of the virus protein at pH 4.5, measure 1.0 to 1.6μ in length and 0.4 to 0.5μ in width, being about one-fourth to one-half the length of those of *Marmor tabaci* in comparative tests.

Distribution: Islands of Grand Canary and Teneriffe.

References to literature: (5, 7, 11, 17, 20, 27).

Marmor anularium, nom. nov.

Tobacco virus 10 Johnson (5); Nicotiana virus 12 Smith (20); *Annulus tabaci* var. *Virginiensis* Holmes (2).

Common name: Tobacco ring-spot virus.

Specific name from Latin, *anularius*, adj., ringlike, referring to the ring spots induced in certain hosts.

Host reactions: In *Nicotiana tabacum* L., a moderately resistant host, induces acute and chronic reactions that are unusually distinct, especially when infection obtains in the young plants. In the acute phase, the virus induces primary and secondary necrotic lesions and chlorotic ring spots, and sometimes secondary chlorotic-line or oak-leaf patterns. In the chronic phase, the virus induces no striking reactions at 20° C., and above, but when culture temperatures are near 16° C., certain tobacco varieties, especially Burley types and certain collections from Colombia, i.e., Ambalema and T.I. 448, manifest mosaic patterns in the young leaves. In *Cucumis sativus* L., var. Early White Spine, a very susceptible host, the virus induces primary necrotic and chlorotic spots, secondary chlorotic spots, and typical mosaic mottling which usually persists throughout the summer growing season. In *Phaseolus vulgaris* L., especially at high temperatures (33.3° C.), induces local necrotic lesions, systemic necrosis and death. This species has a very wide host range including many legumes.

Transmission: By inoculation with expressed juice, readily by wiping carborundum-dusted leaves of thrifty plants with concentrated fresh virus; through a portion of the seeds from diseased tobacco and petunia plants. Insect vectors not known.

Physical and chemical properties: Inactivated near 68° C. in 10 minutes in plant juice; after 3 to 4 days in plant juice at room temperatures; after several months near or below freezing. Does not withstand drying in leaves at room temperature. Dilution end point in plant juice between 1,000 and 10,000 ×; minimal diameter of particles about 15 mμ, passes the fine (W) Berkefeld filter. Regarded as a high molecular-weight protein.

Distribution: Commercial tobacco-growing areas in the United States, especially in the Eastern States.

References to literature: (2, 5, 12, 20).

Fractilinea tritici, sp. nov.

Common name: Russian wheat-mosaic virus.

Host reactions: In *Triticum aestivum* L. (winter and spring varieties), *Avena sativa* L., *A. byzantina* C. Koch, *A. fatua* L., *Hordeum vulgare* L., *Secale cereale* L., induces light-green or yellow mottling or streaking in foliage, proliferation of stalks in some winter wheats (rosette), dwarfing of plants, little or no proliferation in the spring-grown species, great reduction in grain, death frequently in young plants, necrosis of phloem, vacuolar cell inclusions, needle-shaped protein "crystals" in cells when leaf sections are placed in an acid medium.

Transmission: By the leafhopper *Delloccephalus striatus* L. Attempts to transmit the virus by means of the planthopper *Delphacodes striatella* Fall. (*Delphax striatella*), many other insects, and by inoculations with expressed juice met with failure. Attempts to obtain infection through the soil have met with failure.

Distribution: Russia, east of the Ural Mountains, especially in the Voronezh district since about 1935; to some extent near Moscow and south to the Caucasus Mountains.

References to literature: (18, 21, 33, 34, 35, 36, 37).

Fractilinea avenae, sp. nov.

Common name: Siberian oat-mosaic virus (zakooklivanie).

Host reactions: In *Avena sativa* L., *A. strigosa* Schreb., *A. byzantina* C. Koch, *A. fatua* L., and *A. sterilis* L., induces light-green to yellow mottling and streaking in foliage and leaf sheaths; in certain species and varieties of *Avena* induces dwarfing, excessive tillering (rosette), floral deformations, sterility, great

reduction in grain, vacuolar cell inclusions resembling those in *Marmor tritici* var. *typicum*, necrosis of phloem and parenchyma in cases of severe mosaic reaction, vacuolar cell inclusions, giant protein inclusions, "crystals" and fibers. Infection occurs in *Zea mays* L., *Hordeum vulgare* L., *Secale cereale* L., *Panicum miliaceum* L., *Oryza sativa* L., and is suspected in *Triticum aestivum* L., and *Bromus* sp. A few individuals of *Calamagrostis epigeios* (L.) Roth, found susceptible, but the species seems to be very resistant. The virus was found to overwinter in *Agropyron repens* (L.) Beauv., *Bromus inermis* Leyss., *Echinochloa crusgalli* (L.) Beauv. and *Setaria viridis* (L.) Beauv., but in the first three species there seems to be very high resistance, and a small virus reservoir. *Setaria viridis* is very susceptible, highly attractive to the vector and an important reservoir for the virus.

Transmission: By the planthopper *Delphacodes striatella* Fall. (*Delphax striatella*). Attempts to transmit the virus by means of the leafhopper *Deltocephalus striatus* L. and by inoculations with expressed juice have met with failure. Attempts to obtain infection through the soil have also met with failure, though early observers postulated the overseasoning of the virus in the soil.

Distribution: Over most of Siberia from the Ural Mountains, to the Pacific coast, but more especially in the vicinity of Omsk, since 1922. In Japan the virus of rice-stripe disease is also transmitted by *Delphacodes striatella*, thus suggesting that the two diseases may be caused by similar or identical viruses.

References to literature: (16, 22, 23, 24, 25, 26).

Galla zeae, sp. nov.

Common name: Wallaby-ear disease of corn (maize).

Host reactions: In *Zea mays* L., induces, in young plants, small swellings on secondary veins on undersides of top leaves, suggesting the galls associated with the Fiji disease of sugarcane, veins swelling rapidly from the tip to base of the leaf blade; inward rolling of leaves as in drought; green color accentuated, dwarfing of plant and all of its organs. Older plants give mild reactions.

Transmission: By the leafhopper *Cicadula bimaculata* Evans.

Distribution: Southeastern Queensland, Australia.

Reference to literature: (19).

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BOTANY.—*Additional records of aquatic Phycomycetes isolated from Mexican soils.*

LELAND SHANOR, University of Illinois.[1] (Communicated by W. W. DIEHL.)

A relatively small number of aquatic Phycomycetes have been collected in Mexico. Wolf (1939) reported eight species which are distributed among three orders, the Blastocladiales, the Saprolegniales, and the Leptomitales. Stüben (1939) obtained a blastocladiaceous species, described as *Sphaerocladia variabilis*, from Mexican soil. Couch and Whiffen (1942) have transferred *Sphaerocladia variabilis* to the genus *Blastocladiella*, renaming it *Blastocladiella stübenii*. Nabel (1939) obtained from Mexico the interesting phycomycete *Rhizidiomyces bivellatus*, a species belonging in the order Anisochytridiales (Karling, 1943). The author (Shanor, 1942) discovered and described *Monoblepharella mexicana*, this being the first representative of the order Monoblepharidales to be reported from this area. Therefore, to date, five orders of the aquatic Phycomycetes are represented among the fungi that have been collected in Mexico.

It is the purpose of the present paper to record other aquatic Phycomycetes that have been isolated from Mexican soils, adding representatives of two more orders. The large and widely distributed order Chytridiales is not represented by any species previously reported. The most numerous isolates encountered in the present study belong to this group.

The majority of the soil samples from which the fungi to be reported here were isolated were generously procured for me during the summer of 1941 by William C. and Mrs. Martha M. Leavenworth, members of the Fourth Hoogstraal Biological Expedition to Mexico. The manner in which these samples were collected and subsequently handled was described briefly in the introductory remarks to my previous paper.

Through the courtesy of Prof. H. J. Fuller, additional samples were collected during February, 1942, and made available for my study. These samples were taken from moist soil, allowed to dry, and then placed in carefully sealed envelopes and later mailed to the Botanical Laboratory of the University of Illinois, where they were put in jars to which were added sterilized distilled water and suitable substrata for growth of aquatic Phycomycetes. As fungal growth appeared on these materials, individual species were isolated from them for more careful study.

With very few exceptions all the samples collected by the Leavenworths were taken at high altitudes and from soil rich in humus. The samples obtained by Professor Fuller were from much lower altitudes and were mostly from somewhat sandy or from clay soils. All isolates belonging to the rather widely distributed genus *Allomyces* obtained in the present study were secured from the samples taken at the lower altitudes. Isolates of *Allomyces* were obtained much more frequently than species of other genera from the Mexican soil samples collected and studied by Wolf (1939).

The following résumé of species found includes collection data submitted with the soil samples from which isolates were obtained. Additional distributional data pertaining to the species recorded here are to be found in recently published works by Coker and Matthews (1937), Middleton (1943), and Sparrow (1943).

Order CHYTRIDIALES

Family RHIZIDIACEAE

Rhizophlyctis rosea (deBary and Woronin) Fischer

Rabenhorst Kryptogamen—Fl. 1 (4): 122. 1892.

(1) From mud taken on north side of Mount Tancitaro at elevation of about 11,000 feet; July 23, 1941. Leavenworth and Leavenworth.

(2) From mud and humus from wet meadow on north side of Mount Tancitaro at elevation of about 10,000 feet; July 24, 1941. Leavenworth and Leavenworth.

(3) From clay soil taken from meadow near Monterrey; February 5, 1942. Fuller.

(4) From clay soil taken at Córdoba, Veracruz; February 20, 1942. Fuller.

(5) From mud taken from forest near Taxco; February 22, 1942. Fuller.

This species was isolated more frequently than any other chytrid. Vigorous growth was

[1] Received May 29, 1944.

obtained on pieces of corn-seedling leaves, grass leaves, and on cellophane bait. Resting spores were formed abundantly on the pieces of corn-seedling leaves and on cellophane and were similar to those described by Ward (1939). No attempt was made to demonstrate in these isolates the heterothallic nature of this species as reported by Couch (1939).

Rhizophlyctis petersenii Sparrow

Proc. Amer. Phil. Soc. 78 (1): 48. 1937.

(1) From mud and humus from wet meadow along stream north side of Mount Tancitaro at elevation of 10,000 feet; July 24, 1941. Leavenworth and Leavenworth.

(2) From clay soil from Córdoba, Veracruz; February 24, 1942. Fuller.

The sporangia of these isolates varied considerably in size. The long exit tube and the behavior of spores upon emergence are distinctive characteristics of the species. Resting spores have been observed several times which were similar to those described by Sparrow (1937).

Family CHYTRIDIACEAE

Cylindrochytridium johnstonii Karling

Bull. Torrey Bot. Club 68: 382. 1942.

(1) From mud from a wet meadow along north side of Mount Tancitaro at an elevation of 10,000 feet; July 24, 1941. Leavenworth and Leavenworth.

This fungus was isolated only once. It produced sporangial thalli abundantly on corn-seedling leaves and on pieces of lens paper and on filter paper. Resting bodies were found in considerable numbers on a small piece of brown paper in the original sample, and a few formed after a long time on pieces of filter paper used as a substratum. These were nearly spherical, with thick, smooth, light-brown or amber-colored walls, and each possessed one large yellowish oil globule when mature.

I have also isolated this species on seed coats of hemp seed placed in water samples from central Illinois. In view of the recent data published by Karling (1942), it appears that this handsome chytrid is rather widely distributed in southeastern and central United States.

Endochytrium operculatum (deWild.) Karling

Amer. Journ. Bot. 24: 353. 1937.

(1) Mud from stream north side of Mount Tancitaro at elevation of 10,000 feet; July 24, 1941. Leavenworth and Leavenworth.

(2) Soil from La Majada; August 6, 1941. Leavenworth and Leavenworth.

Sporangia and resting bodies were produced abundantly on filter paper and on corn-seedling leaves.

Family MEGACHYTRIACEAE

Nowakowskiella elegans (Nowak.) Schroeter

Eng. and Prantl. Naturlichen Pflanzenfam. 1 (1): 82. 1892.

(1) Mud from wet meadow along a stream on north side of Mount Tancitaro at an elevation of 11,000 feet; July 24, 1941. Leavenworth and Leavenworth.

(2) Soil from La Majada; August 8, 1941. Leavenworth and Leavenworth.

(3) Soil from meadow near Monterrey; February 5, 1942. Fuller.

(4) Clay soil from near Veracruz; February 20, 1942. Fuller.

Although sporangia were produced abundantly on cellophane, lens paper, filter paper, hemp seed, and corn-seedling leaves, I was unable to obtain resting bodies from any of these isolations.

Nowakowskiella hemisphaerospora Shanor

Amer. Journ. Bot. 29: 174. 1942.

(1) In leaf tissue included with soil from wet meadow, north side of Mount Tancitaro, elevation 10,000 feet. Leavenworth and Leavenworth.

Although I have not obtained isolations of this fungus from any of the samples collected, it is being included provisionally in this list of Mexican aquatic fungi on the basis of resting bodies observed in the tissue of some partially decomposed leaf. The resting bodies of this species are so distinctive that they are not likely to be confused with resting bodies of any similar known species.

Karling (1942) reports obtaining this chytrid from a number of localities in southeastern and south-central United States.

Family CLADOCHYTRIACEAE

Cladochytrium replicatum Karling

Amer. Journ. Bot. 18: 538. 1931.

(1) From soil and humus from near Veracruz; February 20, 1942. Fuller.

This single isolation produced sporangia abundantly, but resting bodies were rarely found and all observed were of the smooth-walled type.

Cladochytrium hyalinum Berdan

Amer. Journ. Bot. 28: 425. 1941.

(1) Wet meadow along side of stream, north side of Mount Tancitaro at an elevation of 10,000 feet; July 24, 1941. Leavenworth and Leavenworth.

The single isolation was obtained on cellophane and on pieces of boiled corn leaves. Resting bodies were not produced in any abundance by this isolate.

Order BLASTOCLADIALES

Family BLASTOCLADIACEAE

Allomyces javanicus Kniep

Berichte Deutsch. Bot. Ges. 47: 211. 1929.

(1) Meadow near Monterrey; February 5, 1942. Fuller.

(2) Soil from forest near Taxco; February 22, 1942. Fuller.

In both of these isolations gametophyte plants appeared only rarely among sporophytes and were not seen at all until after several months' study and after several attempts to obtain them from resistant sporangia that had been allowed to become dry had proved unsuccessful. Male gametangia were more numerous than female gametangia and were found in some cases along main branches on which resistant sporangia were formed. These two isolates should probably be assigned to var. *perandrus* of Emerson (1941).

Allomyces anomalus Emerson

Lloydia 4: 133. 1941.

(1) Soil from near Veracrus; Feburary 20, 1942. Fuller.

During a period of over six months while this isolate had been under observation, I was unable to obtain gametophytes or cyst formation so am provisionally assigning it to this species proposed by Emerson to include isolates in which sexual reproduction is apparently lacking.

Order MONOBLEPHARIDALES

Family MONOBLEPHARIDACEAE

Monoblepharella mexicana Shanor

Mycologia 34: 242. 1942.

(1) Soil from wet meadow along stream on north side of Mount Tancitaro at an elevation of 10,000 feet; July 24, 1941. Leavenworth and Leavenworth.

(2) Soil from forest near Taxco. February 22, 1942. Fuller.

This very interesting fungus was first described in considerable detail from the isolates obtained from the Mount Tancitaro samples. The isolate from Taxco agrees in all major aspects with those obtained from the type locality.

Order SAPROLEGNIALES

Family SAPROLEGNIACEAE

Achlya flagellata Coker

The Saprolegniaceae: 116. 1923.

(1) Soil from wet meadow along stream on north side of Mount Tancitaro at an elevation of 11,000 feet; July 23, 1941. Leavenworth and Leavenworth.

This isolate did not appear on hemp seed that was placed in the battery jar until several months after the soil sample was put into the jar and flooded with sterilized distilled water.

Order PERONOSPORALES

Family PYTHIACEAE

Pythium debaryanum Hesse

Inaugr. Dissert. Halle. 1894.

(1) Soil from La Majada; August 8, 1941. Leavenworth and Leavenworth.

This isolate was found to be highly pathogenic to the following seedlings planted in flats of sterilized soil into which it was introduced: garden peas (*Pisum sativum* L.), watermelon (*Citrullus vulgaris* Schrad.), cucumber (*Cucumis sativus* L.), spinach (*Spinacia oleracea* L.), tomato (*Lycopersicon esculentum* Mill.), beet (*Beta vulgaris* L.), and radish (*Raphanus sativus* L.).

Pythium graminicolum Subramaniam

Agr. Res. Inst. Pusa Bull. 177: 1–5. 1928.

(1) From soil from meadow near Monterrey; February 5, 1942. Fuller.

This is a widely distributed species both in the Eastern and Western Hemispheres. During the present study it was isolated on hemp seed and on pieces of corn-seedling leaves.

SUMMARY

Fourteen species of aquatic Phycomycetes are reported that were obtained from Mexican soil samples. They are distributed as follows:

CHYTRIDIALES—*Rhizophlyctis rosea, R. petersenii, Cylindrochytridium johnstonii, Endochytrium operculatum, Nowakowskiella elegans, N. hemisphaerospora, Cladochytrium replicatum,* and *C. hyalinum.*

BLASTOCLADIALES—*Allomyces javanicus* and *A. anomalus.*

MONOBLEPHARIDALES—*Monoblepharella mexicana.*

SAPROLEGNIALES—*Achlya flagellata.*

PERONOSPORALES—*Pythium debaryanum* and *P. graminicolum.*

With the exception of the two species of *Allomyces* and of *Monoblepharella mexicana,* none of these species appears to have been reported previously from Mexico.

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ENTOMOLOGY —*Descriptions of nine species of* Aleuroplatus *from eastern North America* (Homoptera: Aleyrodidae).[1]

LOUISE M. RUSSELL, Bureau of Entomology and Plant Quarantine. (Communicated by C. F. W. MUESEBECK.)

The species of *Aleuroplatus* Quaintance and Baker treated here form a well-defined group and are closely allied. Owing to their structural similarity and to the difficulty of obtaining microscopic preparations satisfactory for critical study, the species frequently have been confused with one another. The pupae, the stage on which this study is based, usually can be more successfully mounted when recently emerged than after they are mature and have become black, brittle, and covered with wax. This group of whiteflies appears to be of actual or potential economic importance, for several species occur on plants of commercial value, and one is suspected of being a vector of the blueberry stunt virus disease.

[1] Received May 26, 1944.

Types of the species discussed are in the collection of the United States National Museum.

Botanists of the Division of Plant Exploration and Introduction, Bureau of Plant Industry, Soils, and Agricultural Engineering, United States Department of Agriculture, kindly identified several plants and checked the names of the hosts.

The following combination of characters distinguishes these species from other members of *Aleuroplatus:* Marginal teeth moderately rounded, slightly wider than long; submarginal disk pores (for terminology see Russell, Proc. Ent. Soc. Washington 45: [131]–132, 1943) in a single row less than five times the width of a marginal tooth from marginal teeth; without conspicuous

sculpturing along median molting suture; dorsal minute spinelike points absent; transverse molting suture terminating nearly opposite its midpoint, disk pores not in a row posterior to its distal portions; submedian meso- and metathoracic setae shorter than segment bearing them, or absent; cephalic setae present, shorter than metathorax; eighth abdominal setae located just laterocephalad of vasiform orifice; vasiform orifice not largely covered by a transparent membrane; minute spines on ventral surface, in a band paralleling body margin.

The species may be separated by the following key:

1. Submedian mesothoracic and metathoracic setae present.....2
   Submedian mesothoracic and metathoracic setae absent.....6
2. Vasiform orifice with a well-defined tongue, bottom of orifice extending just anterior to posterior margin of operculum; eye spots inconspicuous, slightly lighter than adjacent derm, not elevated.....3
   Vasiform orifice without a well-defined tongue, if with a tooth then bottom of orifice extending nearly to anterior margin of operculum; eye spots conspicuous, much lighter than adjacent derm, elevated.....5
3. Vasiform orifice nearly as wide as long, approximately its length from body margin; caudal setae nearer to submarginal teeth than to orifice; central subdorsal disk pores usually absent from abdominal segments 4–7 .....*myricae* Quaintance and Baker
   Vasiform orifice distinctly longer than wide and less than its length from body margin; caudal setae nearer to orifice than to submarginal teeth; central subdorsal disk pores usually present on abdominal segments 4 and 5 and sometimes on 6 and 7.....4
4. Sides of vasiform orifice opposite operculum of nearly uniform thickness and sclerotization, nearly vertical from bottom to rim, slightly removed from operculum, a curved tongue arising from bottom of orifice about midway between operculum and end of orifice (fig. 3); abdominal minute setal bases usually near central subdorsal disk pores; posterior end of body noticeably broader than anterior end .....*plumosus* (Quaintance)
   Sides of vasiform orifice opposite operculum somewhat thickened and heavily sclerotized on lower portion, forming a vertical wall close to the operculum, the wall abruptly interrupted posteriorly and a spatulate tongue in interval between its ends, membrane sloping from wall to rim (fig. 4); abdominal minute setal bases usually near inner subdorsal disk pores except on segment 3; posterior end of body nearly as narrow as anterior end.....*semiplumosus*, n.sp.
5. Vasiform orifice without a tooth, its sides slightly convex laterally and strongly so posteriorly, membrane extending from edge of convex portion to posteriorly projecting rim, bottom of orifice extending just anterior to posterior margin of operculum (fig. 6); dorsal abdominal disk pores rather numerous, 7–9 pairs on each of segments 3 and 4, usually 3 submedian pairs on each of segments 1 and 3–6; body slightly constricted at posterior third.....*magnoliae*, n. sp.
   Vasiform orifice with a tooth, its sides convex opposite operculum but nearly vertical posteriorly, membrane extending from bottom to vertical rim, bottom of orifice extending nearly to anterior margin of operculum (fig. 7); dorsal abdominal disk pores less numerous, 2 or 3 pairs on each of segments 3 and 4, 1 submedian pair on each of segments 1–6; body rather strongly constricted at posterior third.....*ilicis*, n. sp.
6. Dorsal abdominal disk pores fairly numerous, 1 submedian pair on each of segments 1–6, and a total of 2–4 pairs on each of segments 3 and 4; body constricted at posterior third; eye spots at least moderately conspicuous..7
   Dorsal abdominal disk pores more numerous, 1 or 2 submedian pairs on each of segments 1–6, but a total of 5–13 pairs on each of segments 3 and 4; body not constricted at posterior third; eye spots inconspicuous....8
7. Bottom of vasiform orifice reaching nearly as far anteriorly as operculum, a tooth just posterior to operculum, sides of orifice convex anteriorly, orifice usually slightly longer than wide; eighth abdominal setae much shorter than, and caudal ones about as long as, width of orifice.....*liquidambaris*, n. sp.
   Bottom of vasiform orifice reaching just anterior to posterior margin of operculum, a tongue at end of orifice, sides of orifice nearly vertical anteriorly, orifice practically as wide as long (fig. 8); eighth abdominal setae nearly as long as, and caudal setae much longer than, width of orifice..*vaccinii*, n. sp.
8. Subdorsal disk pores fairly numerous on abdominal segments 3–5, 3–5 pairs on segment 3, 2–4 pairs on segment 4, and 1–3 pairs on segment 5; vasiform orifice at least its length from body margin; caudal setae nearer together than eighth abdominal ones..... .....*epigaeae*, n. sp.
   Subdorsal disk pores unusually numerous on abdominal segments 3–5, 8–13 pairs on segment 3, 5–9 pairs on segment 4, and 4 or 5 pairs on segment 5; vasiform orifice slightly less than its length from body margin; caudal setae slightly farther apart than eighth abdominal ones.....*bignoniae*, n. sp.

Aleuroplatus plumosus (Quaintance)

Aleurodes plumosa Quaintance, U. S. Dept. Agr., Div. Ent., Tech. Ser. 8: 33–35, illus., in part. 1900.

Tetraleurodes plumosa (Quaintance), Quaintance and Baker, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 108, in part. 1914.

Aleuroplatus plumosus (Quaintance), Quaintance and Baker, Proc. U. S. Nat. Mus. 51: 394–395, illus., in part. 1917.

In the original treatment of *A. plumosus* Quaintance stated, "A rather common species in Florida hammocks and higher woodlands; on leaves of various plants, as *Persea carolinensis, Magnolia grandiflora; M. glauca; Ilex opaca; Viburnum nudum* and *Vaccinium* spp." It is uncertain whether specimens from each of these hosts were before Quaintance when he prepared the description of *plumosus*, but at the present time none from *Ilex* or *Viburnum* are in his aleyrodid material in Washington. Quaintance did not designate a holotype of *plumosus*; he included more than one species under the name; and his description applies to one species as well as to another. In 1917 Quaintance and Baker designated a type lot consisting of three mounted specimens, a pupa and one crushed adult of each sex; this pupa should be regarded as the lectotype of the species. These specimens are labeled as having been collected from *Quercus*, a host not specifically listed by Quaintance and not recorded elsewhere in the present paper.

The specimens stated by Quaintance and Baker, in 1917, to be abundant on cranberry in Cranmoor, Wis., apparently should have been recorded from leatherleaf. In unmounted material from this source all specimens of *plumosus* are from leatherleaf, those from cranberry representing the species *epigaeae*. Information associated with this material states that the insects were common on leatherleaf and were found occasionally on cranberry. Quaintance and Baker also assigned some other specimens to *plumosus* which actually belong elsewhere.

Living on the lower surface of leaves.

Perfect specimens with a whitish, waxy exudation extending outward from submargin and upward from dorsum in thin sheets, dorsal tranverse sheets coalesced with longitudinal ones.

Oval, widest across abdominal segments 2 and 3, anterior end almost pointed or narrowly curved, narrower than the broadly curved posterior end; measuring 0.75–1 mm long and 0.50–0.75 wide (males in lower brackets of figures). Black, heavily sclerotized.

Marginal teeth rounded, slightly wider than long, somewhat variable in width, 13–17 in 100μ; 3–5 at each tracheal pore area longer and with incisions between them wider at base than incisions between other teeth. Submarginal teeth equidistant from and about the width of a tooth from marginal teeth, smaller than marginal ones, 3–5 at each tracheal pore area larger than others; their apices heavily and the remainder rather lightly sclerotized. Ridges extending from margin to submarginal disk pores. Submarginal disk pores in a single row, some irregularly spaced and placed, the majority two to three times the width of a marginal tooth from marginal teeth, absent opposite tracheal pore areas, approximately one-third as numerous as teeth.

Transverse molting suture curved posteriorly from its midpoint but recurved cephalad and terminating nearly opposite its center, in outer subdorsum. Cephalothoracic suture weak or absent, pro-mesothoracic suture rather weak, other segmental sutures well defined to inner subdorsum; third through seventh abdominal ones weakly defined to outer subdorsum, their ends curved cephalad. Eye spots transverse, slightly lighter than adjacent derm, inconspicuous. A submedian pair of cephalic, mesothoracic and metathoracic setae, each less than 9μ long; eighth abdominal setae about 60μ, located just laterocephalad of vasiform orifice; caudal setae about 80μ, slightly nearer together than eighth abdominal pair, slightly nearer to orifice than to submarginal teeth, a small, transverse thickening between them. A pair of minute setal bases usually near central subdorsal disk pores on each of abdominal segments 3–6, sometimes a central subdorsal pair on prothorax, posterior to eye spots. Dorsal disk pores somewhat variable in number and position, the subdorsal ones often less numerous in males than in females; abdominal ones usually grouped; pairs arranged approximately as follows: Cephalic segment, 1–3 near median line in center of segment and 1 each side of cephalic setae; prothorax, 1 near median line and 1 (usually central) subdorsal; meso-

thorax, 2 near setae, 2 inner subdorsal (or 1 outer submedian), and 1 central subdorsal; metathorax, 1 or 2 near setae, 2 inner subdorsal (or 1 outer submedian), and 2 or 3 central subdorsal; first abdominal, 2 submedian; second abdominal, 1 submedian; third through sixth, each 2 submedian, 1 inner and 1–3 (usually 2 or 3) central subdorsal; seventh, 1 submedian, 1 inner and 0 or 1 central subdorsal; eighth, 1 inner subdorsal (opposite widest part of orifice). Vasiform orifice less than its length from body margin, longer than wide, measuring about 50–60μ long (from rim at anterior end to edge of rim around posterior end) and 36–46 wide; its rim rather thick and pronounced, and entirely vertical or produced diagonally backward at posterior end; sides of orifice nearly vertical, its bottom extending just anterior to posterior margin of operculum; an apically curved, transverse tongue midway between operculum and end of orifice. Operculum sculptured, broadly curved posteriorly, 24–30μ long and wide.

Minute spines on ventral surface, in a band paralleling body margin.

Lectotype.—U.S.N.M. No. 19195. Florida, from *Quercus*.

Redescribed from a few unmounted specimens and about 55 mounted ones as follows: *Quercus* sp., Florida, A. L. Quaintance, 9-1-98 (lectotype); *Magnolia* sp., Florida, paratypes; *Persea borbonia* (L.) Spreng. (= *P. carolinensis* Nees), Florida, A. L. Quaintance, 5-25-98 (possibly paratype but not so labeled); myrtle bay, Citra, Fla., February 10, 1895; leatherleaf, Cranmoor, Wis., C. W. Hooker, April 25 and August 27, 1910; leatherleaf, April 17, and blueberry, July 18, 1914, Pemberton, N. J., H. B. Scammell; inkberry, Whitesbog, N. J., H. B. Scammell, February 17, 1915, and March 13, 1916; *Myrica* sp., Lake Weir, Fla., H. W. Fogg, October 1923; laurel, Washington, D. C., W. B. Wood, July 26, 1927; *Kalmia* sp., Silver Spring, Md., Louise M. Russell, October 11, 1942; *Vaccinium corymbosum* L., Pemberton, N. J., C. S. Beckwith, September 27, 1943.

Aleuroplatus semiplumosus, n. sp.

Differing from *A. plumosus* as follows: Body widest across abdominal segments 1 and 2, posterior end nearly as narrow as anterior end. No thickening between caudal setae. Two central subdorsal pairs of minute setal bases on prothorax, abdominal ones usually near inner subdorsal disk pores except on segment 3. Submedian and inner subdorsal disk pores on abdominal segments 3–5 somewhat equally spaced rather than grouped; 2 or 3 submedian and inner subdorsal, and 3 or 4 central subdorsal (a total of 7 or 8) pairs on segment 3; 1–3 inner and central subdorsal pairs on segments 4, 5, and sometimes on 6, but central subdorsal sometimes absent from segments 5 and 6, and usually absent from segment 7. Vasiform orifice 56–64μ long and 36–44 wide; lower part of sides opposite operculum forming a somewhat thickened and heavily sclerotized vertical wall close to the operculum and following its curve, the wall interrupted abruptly at its posterior end and a somewhat spatulate tongue in interval between its ends; membrane sloping outward and upward from wall to rim of orifice.

Type.—U.S.N.M. No. 56951. Norfolk, Va., from *Persea*.

Described from many unmounted specimens and 91 mounted ones as follows: *Ilex opaca* Ait., Vienna, Va., A. C. Baker, March 2, 1912; holly, Urbana, Ill., C. O. Woodworth, December 23, 1915; Lauraceae, Bamboo Garden near Savannah, Ga., H. L. Sanford, February 28, 1922; American holly, Silver Spring, Md., Carlo Zeimet, April 2, 1922; laurel, Bethesda, Md., R. D. Kennedy, April 26, 1922; *Sassafras albidum* (Nutt.) Nees, Rock Creek Park, Washington, D. C., J. E. Walter, August 6, 1922; laurel, Cass, W. Va., F. W. Gray, August 1922; *Nyssa sylvatica* Marsh.? and laurel, Black Mountain, N. C., Carlo Zeimet, September 7, 1922; holly, Holly Springs, Miss., T. F. McGehee (from R. W. Harned), 1922; *Persea* sp., New Orleans, La., H. L. Dozier, January 20, 1923; *Ilex* sp., Glendale, Md., R. G. Cogswell, September 27, 1923; *Rhododendron* sp., Baltimore, Md., C. E. Prince, May 9, 1924; *Kalmia latifolia* L., Fort Myer, Va., H. L. Sanford, May 27, 1924; *Rhododendron* sp., Kennett Square, Pa., W. B. Wood, August 10, 1932, and W. W. Chapman and W. J. Ehinger, June 25, 1935; *Kalmia latifolia* L., near Sperryville, Va., H. H. Keifer, June 4, 1940; *Kalmia* sp. and *Ilex* sp., Silver Spring, Md., Louise M. Russell, April 29, 1943; *Persea borbonia* (L.) Spreng., Norfolk, Va., L. D. Anderson, August 10 and 30 (including holotype), 1943; *Persea pubescens* (Pursh)

Sarg., Richmond Hill, Ga., L. A. Mayer, December 2, and Max Kisliuk, December 13, 1943.

The only available third-stage specimen of this species has submedian mesothoracic and metathoracic setae, and a vasiform orifice similar to that of the pupae.

Aleuroplatus myricae Quaintance and Baker

Aleuroplatus myricae Quaintance and Baker, Proc. U. S. Nat. Mus. 51: 389–390, illus. 1917.
Aleuroplatus plumosus (Quaintance), Quaintance and Baker, Proc. U. S. Nat. Mus. 51: 395, in part. 1917.

A specimen from cranberry, New Egypt, N. J., assigned to *plumosus* by Quaintance and Baker, belongs to *myricae*.

Differing from *A. plumosus* as follows: Widest across abdominal segments 1 and 2, posterior end of body nearly as narrow as anterior end. Caudal setae nearer to submarginal teeth than to vasiform orifice. Abdominal minute setal bases usually near inner subdorsal disk pores except on segment 3, sometimes absent from any one of segments 4–6. Dorsal disk pores less numerous, usually 1 submedian and 2 subdorsal pairs on meso- and metathorax, frequently only 1 submedian pair on one or another of abdominal segments 1 and 4–6, abdominal central subdorsal ones usually present only on segment 3. Vasiform orifice around 45μ long and 40 wide, approximately its length from body margin; tongue at end of orifice.

Lectotype.—U.S.N.M. No. 19198. Griffin, Ga., from *Myrica*.

Redescribed from a few unmounted specimens and 30 mounted ones as follows: *Myrica pensylvanica* Loisel. (identified by botanists of U. S. Dept. Agr.), Griffin, Ga., A. L. Quaintance, April 25, 1899 (including lectotype, hereby designated); cranberry, New Egypt, May 21, 1914, and New Lisbon, April 26, 1915, and sheep laurel, Pemberton, N. J., February 23, 1915, H. B. Scammell; *Kalmia* sp. and *Rhododendron nudiflorum* (L.) Torr., Sligo Park, Silver Spring, Md., Louise M. Russell, November 6, 1943.

The only available third-stage specimen of *myricae* has submedian meso- and metathoracic setae, and a vasiform orifice similar to that of the pupae.

Aleuroplatus magnoliae, n. sp.

Aleurodes plumosa Quaintance, U. S. Dept. Agr., Div. Ent., Tech. Ser. 8: 33–35, in part. 1900.
Tetraleurodes plumosa (Quaintance), Quaintance and Baker, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 108, in part. 1914.
Aleuroplatus plumosus (Quaintance), Quaintance and Baker, Proc. U. S. Nat. Mus. 51: 394–395, in part. 1917.

The specimens treated here doubtless are the ones from *Magnolia glauca* included under *plumosus* by Quaintance; some are labeled *plumosus* but are not marked cotype.

Differing from *A. plumosus* as follows: Slightly constricted at posterior third. Submarginal disk pores approximately one-half as numerous as teeth, usually forming a double row in spots; porettes of these and dorsal disk pores relatively conspicuous. Eye spots conspicuous, much lighter than adjacent derm, slightly elevated, irregularly elliptical. No thickening between caudal setae. Two central subdorsal pairs of minute setal bases on prothorax, abdominal ones usually inner subdorsal except on segment 3. Three submedian pairs of disk pores on first, and 2 on second abdominal segment; each of abdominal segments 3–6 with a row of pores ending slightly mesad of central subdorsal area, those at ends of row grouped on segments 3 and 4; usually 3 submedian pairs on each of segments 3–6; 6 subdorsal pairs on segment 3, 4 or 5 on segment 4, 3 or 4 on segment 5, 2 or 3 on segment 6; 2 submedian and 1 subdorsal pair on segment 7. Sides of vasiform orifice slightly convex laterally and strongly so posteriorly, at posterior end the upper portion of convex area rimlike and nearly as high as operculum, membrane sloping from this rim to outer edge of true rim of orifice which projects backward; orifice measuring 56–60μ long and 40–44 wide; without a tongue.

Type.—U.S.N.M. No. 56952. Lake City, Fla., from *Magnolia*.

Described from 17 mounted specimens from *Magnolia virginiana* L. (= *M. glauca* L.), Lake City, Fla., A. L. Quaintance.

Aleuroplatus ilicis, n. sp.

No conspicuous waxy exudation observed, body covered by a thin coating of transparent glassy wax.

Differing from *A. plumosus* as follows: Body constricted at posterior third, bulging anterior to this point. Eye spots conspicuous, much lighter than adjacent derm, slightly elevated, subcircular to roughly elliptical. Eighth abdominal setae around 12μ long; caudal setae usually around 40μ, no thickening between them. Usually 2 pairs of central subdorsal minute setal bases on prothorax and 0 on abdomen. Dorsal disk pores less numerous, usually 1 pair near cephalic and mesothoracic, and 0 near metathoracic setae; 1 inner and 1 central subdorsal pair on each thoracic segment; 1 submedian pair on each of abdominal segments 1–7, 1 inner subdorsal pair on each abdominal segment, and 1 central subdorsal pair on segment 3 and occasionally on segment 4 or 5. Vasiform orifice approximately its length from body margin, usually slightly longer than wide but sometimes as wide as long, measuring 44–56μ long and 40–48 wide; sides of orifice thickened, strongly sclerotized, and strongly convex opposite operculum, thinner and nearly vertical at posterior end; bottom of orifice extending cephalad nearly as far as operculum; a flat or peglike tooth arising from bottom of orifice at end of operculum.

Type.—U.S.N.M. No. 56953. Silver Spring, Md., from *Ilex.*

Described from many unmounted specimens and 66 mounted ones as follows: Holly, Urbana, Ill., C. O. Woodworth, December 23, 1915; *Kalmia* sp., Lea Springs, Tenn., October 4, 1909; *Ilex* sp., near Brooksville, Fla., H. L. Sanford, February 14, 1922; laurel, Cass, W. Va., F. W. Gray, August 1922; laurel, Black Mountain, N. C., Carlo Zeimet, September 7, 1922; holly, Holly Springs, Miss., T. F. McGehee (from R. W. Harned), 1922; holly, Richmond, Va., F. R. Freund, May 4, 1939; *Ilex opaca* Ait., Silver Spring, Md., Louise M. Russell, May 10 (including holotype) and June 7, 1942; holly, Gordo, Ala., collected in Calif. by D. D. Sharp (from H. L. McKenzie), December 22, 1942; common and dahoon holly, Chapel Hill, N. C., F. J. LeClair (from C. S. Brimley), May 4, 1943; *Ilex* sp., Richmond Hill, Ga., Max Kisliuk, December 6, 1943.

Mesothoracic and metathoracic setae are present in the only third-stage specimen available. In this insect the bottom of the vasiform orifice is relatively much shorter than in the pupa and there is a suggestion of a spatulate tongue at the end of the orifice. In three first-stage specimens at hand the submedian meso- and metathoracic setae are present and are practically the same size as the cephalic ones.

This species is sometimes abundant, literally covering the lower surface of the leaves. It is very difficult to mount satisfactorily.

Aleuroplatus liquidambaris, n. sp.

Aleurodes plumosa Quaintance, U. S. Dept. Agr., Div. Ent., Tech. Ser. 8: 33–35, in part. 1900.
Tetraleurodes plumosa (Quaintance), Quaintance and Baker, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 108, in part. 1914.
Aleuroplatus plumosus (Quaintance), Quaintance and Baker, Proc. U. S. Nat. Mus. 51: 394–395, in part. 1917.

Some specimens originally assigned to *plumosus* by Quaintance, and apparently later considered as belonging to that species by Quaintance and Baker, must be transferred to *liquidambaris.*

Differing from *A. ilicis* in lacking submedian meso- and metathoracic setae, in sometimes having a metathoracic submedian pair of disk pores, and in usually having at least 1 pair of abdominal minute setal bases.

Type.—U.S.N.M. No. 56954. New Orleans, La., from *Liquidambar.*

Described from a few unmounted specimens and 40 mounted ones as follows: *Vaccinium* sp., Florida, A. L. Quaintance (labeled cotype of *plumosus*); *Magnolia* sp. (presumably *grandiflora* L., judged from Quaintance collection notes and data published with *plumosus*), Florida, A. L. Quaintance (labeled cotype of *plumosus*); *Asimina* sp., Lake City, Florida, A. L. Quaintance, August 24, 1897; *Liquidambar styraciflua* L., A. L. Quaintance; *L. styraciflua* L., New Orleans, La., H. K. Plank, September 17, 1924 (including holotype); *L. styraciflua* L., St. Leonard, Md., October 6, 1940, and *Pyracantha coccinea* Roem., Silver Spring, Md., October 7, 1941, Louise M. Russell.

Specimens from *Magnolia* and *Vaccinium* differ from the others included here in that most of them have a metathoracic pair of submedian disk pores and at least one pair of abdominal minute setal bases. It is believed, however, that they are conspecific.

This species is very similar to *A. ilicis*, the only seemingly important difference observed

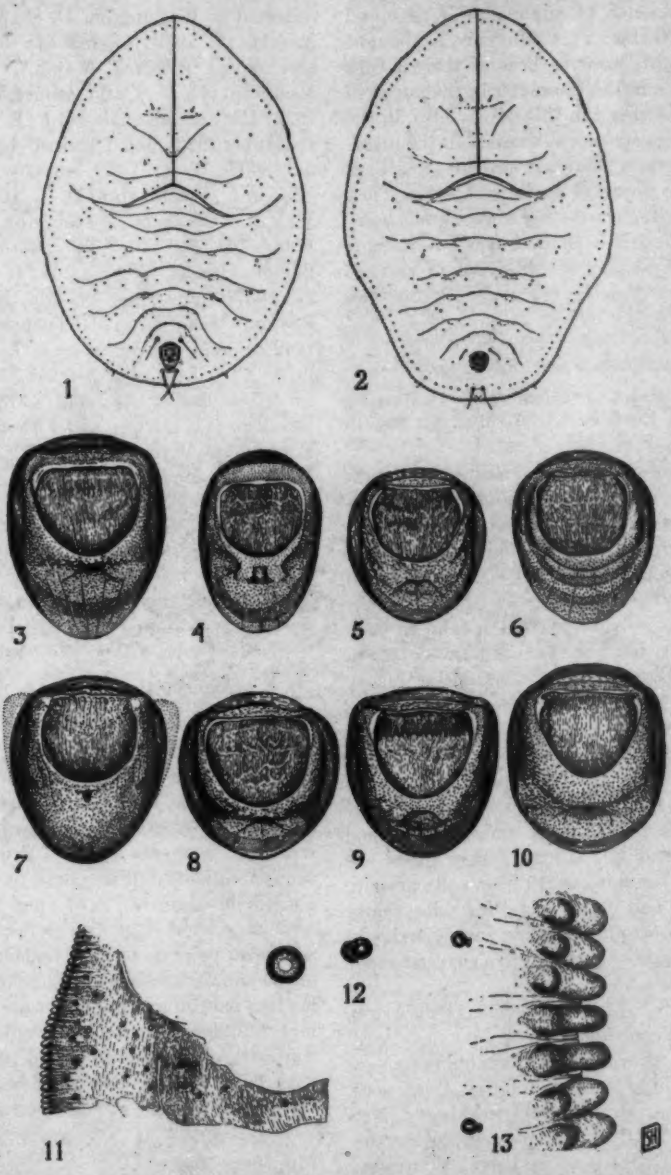

Fig. 1.—*Aleuroplatus plumosus*, dorsum, ×50. Fig. 2.—*A. vaccinii*, dorsum, ×50. Fig. 3.—*A. plumosus*, vasiform orifice, ×460. Fig. 4.—*A. semiplumosus*, vasiform orifice, ×460. Fig. 5.—*A. myricae*, vasiform orifice, ×460. Fig. 6.—*A. magnoliae*, vasiform orifice, ×460. Fig. 7.—*A. ilicis*, vasiform orifice, ×460. Fig. 8.—*A. vaccinii*, vasiform orifice, ×460. Fig. 9.—*A. erigaeae*, vasiform orifice, ×460. Fig. 10.—*A. bignoniae*, vasiform orifice, ×460. Fig. 11.—*A. bignoniae*, half of third abdominal segment, ×165. Fig. 12.—*A. semiplumosus*, minute setal base, disk pore and porette, ×1,500. Fig. 13.—*A. vaccinii*, margin and submargin around thoracic tracheal pore area, ×650. (Drawings by Sara Hoke DeBord.)

being the absence of submedian meso- and metathoracic setae. This difference is thought to be important, however, because there is very little variation in this character in the pupae of the species discussed in this paper. Also, in the few third-stage specimens examined, the meso- and metathoracic setae are present or absent just as in the pupae of the same species. They are absent in the third-stage specimen of *liquidambaris*. There is a distinct spatulate tongue in the vasiform orifice of this specimen, and the bottom of the orifice is relatively shorter than in the pupae.

Aleuroplatus vaccinii, n. sp.

Aleuroplatus plumosus (Quaintance), Quaintance and Baker, Proc. U. S. Nat. Mus. 51: 395, in part. 1917.

Certain specimens from cranberry, New Egypt, N. J., assigned to *plumosus* by Quaintance and Baker belong to this new species.

Differing from *A. ilicis* as follows: Eye spots moderately conspicuous, not elevated. Eighth abdominal setae 35μ long; caudal setae about 60μ, nearer to submarginal teeth than to vasiform orifice, a faint thickening between them. Usually 0 or 1 pair of central subdorsal minute setal bases on prothorax, 1 central subdorsal pair on abdominal segment 3, and usually 1 inner subdorsal pair on segments 4, 5, and sometimes 6. A submedian pair of disk pores on metathorax, and 1 or 2 central subdorsal pairs on each segment of thorax and on abdominal segments 3 and 4. Vasiform orifice about one and one-half times its length from body margin, 40–44μ long and 38–44 wide, its sides nearly vertical, its bottom extending just anterior to posterior margin of operculum; a curved tongue at end of orifice.

Type.—U.S.N.M. No. 56955. Pemberton, N. J., from *Vaccinium*.

Described from many unmounted specimens and 97 mounted ones as follows: Pipsissewa, Orono, Maine, May 6, 1899; cranberry, New Egypt, May 21, 1914, wintergreen, Pemberton, February 23, 1915, and inkberry, Whitesbog, N. J., March 13, 1916, H. B. Scammell; *Chimaphila umbellata* (L.) Barton, Southold, N. Y., from E. P. Felt, October 1919; *Gaylussacia frondosa* (Wang) Torr. & Gray, Takoma Park, Md., Carlo Zeimet, August 6, 1922; *Gelsemium sempervirens* (L.) Ait. f., Savannah, Ga., collected at Washington, D. C., W. T. Owrey, August 11, 1922; *Gaylussacia baccata* Wang and *Nyssa sylvatica* Marsh.?, 1922, Black Mountain, N. C., Carlo Zeimet, September 7, 1922; *Ilex* sp., Glendale, Md., R. G. Cogswell, December 1923; undetermined host, Washington, D. C., W. B. Wood, July 26, 1927; *Kalmia latifolia* L., Washington, D. C., R. G. Cogswell, May 24, 1928; laurel, Washington, D. C., W. B. Wood, June 8, 1931; *Chimaphila umbellata* (L.) Barton, Greensboro, Ind., W. B. Wood, April 27, 1937; *Pyrola* sp., Canada, intercepted at Boston, Mass., J. T. Beauchamp, May 16, 1940; *Vaccinium corymbosum* L., Pemberton, N. J., C. S. Beckwith, August 30 and September 27 (including holotype), 1943; *Chimaphila umbellata* (L.) Barton, and *Vaccinium vacillans* Torr., Sligo Park, Silver Spring, Md., Louise M. Russell, November 6, 1943.

The two available third-stage specimens lack submedian mesothoracic and metathoracic setae and have the vasiform orifice as in the pupae.

This species is suspected of being a vector of the blueberry stunt virus disease.

Aleuroplatus epigaeae, n. sp.

Differing from *A. plumosus* as follows: Submedian meso- and metathoracic setae absent. Caudal setae as near to submarginal teeth as to vasiform orifice. Abdominal minute setal bases inner subdorsal except on segment 3, often absent from segments 5 and 6. Usually 1 pair of central subdorsal disk pores on metathorax; abdominal segments 6, 7, and sometimes 5 without central subdorsal pores, 1 or 2 inner subdorsal pairs on each of segments 3–5, often only 1 submedian pair on segment 6; outer submedian pair on any segment usually as near to inner subdorsal as to inner submedian pair. Vasiform orifice slightly more than its length from body margin, measuring 44–52μ long and 44–48 wide; tongue at end of orifice.

Type.—U.S.N.M. No. 56956. Silver Spring, Md., from *Epigaea*.

Described from many unmounted specimens and 107 mounted ones as follows: Cranberry, Cranmoor, Wis., C. W. Hooker, October 7, 1910 (see discussion under *plumosus*); *Epigaea repens* L., Reading, Pa., J. G. Sanders, May 17, 1917; blueberry (in greenhouse), Washington,

D. C., H. L. Sanford, August 23, 1919; *E. repens* L., Mattituck, N. Y., Roy Latham, July 18, 1920; wintergreen, Albany, N. Y., E. P. Felt, May 16, 1922; laurel, Washington, D. C., W. B. Wood, July 26, 1927, and R. G. Cogswell, May 24, 1928; blueberry (in greenhouse), Washington, D. C., September 2, 1932; *E. repens* L., Prince Edward Island, New Brunswick, and Nova Scotia, Canada, intercepted at Boston, Mass., by J. T. Beauchamp, W. J. Ehinger, and E. Hodson, May 23, 1939, to May 4, 1943; *E. repens* L., Sligo Park, Silver Spring, Md., Louise M. Russell, November 6, 1943 (including holotype).

In the lot containing the holotype, 2 third-stage specimens lack submedian mesothoracic and metathoracic setae; 2 apparently second-stage insects lack mesothoracic setae, but a metathoracic one is suggested on one half of one specimen and on each half of the other; in 10 first-stage insects, mesothoracic and metathoracic setae are present but are much smaller than the cephalic ones. The vasiform orifice of the third-stage specimens is similar to that of the pupae.

This species was abundant on some samples of *Epigaea* examined by the writer. It is rather similar to *A. myricae*.

Aleuroplatus bignoniae, n. sp.

Differing from *A. plumosus* as follows: Submedian mesothoracic and metathoracic setae absent; caudal setae slightly farther apart than eighth abdominal ones and nearer to submarginal teeth than to orifice. Two pairs of central subdorsal minute setal bases on prothorax, abdominal ones usually nearer to inner than to central subdorsal disk pores except on segment 3. One distinctly submedian pair of dorsal disk pores on each of abdominal segments 1–7; subdorsal abdominal ones unusually numerous, more or less grouped in inner, central, and outer subdorsum, the outer ones sometimes nearly indistinguishable from submarginal ones; abdominal segment 3 with 8–13 pairs, segment 4 with 5–9 pairs, segment 5 with 4 or 5 pairs, segment 6 with 2–4 pairs, segment 7 with 1 pair. Vasiform orifice around 56μ long and 48 wide; tongue located at end of orifice.

Type.—U.S.N.M. No. 56957. Brooksville, Fla., from *Bignonia*.

Described from several unmounted specimens and six mounted ones from *Bignonia* sp., Brooksville, Fla., H. L. Sanford, Feb. 11, 1922.

The one available third-stage specimen lacks meso- and metathoracic setae, and has the vasiform orifice similar to that of the pupae.

ZOOLOGY.—*Tests indicating absence of progesterone in certain avian ovaries.*[1]

OSCAR RIDDLE and JAMES PLUMMER SCHOOLEY,[2] Carnegie Institution of Washington, Cold Spring Harbor, N. Y.

Histological evidence of the presence of luteal tissue in the ovary of fowl, and of some other birds, has been frequently asserted and perhaps still more frequently denied. This subject was treated extensively by Fell (1925). In reptiles, however, histological studies seem to have demonstrated the presence of a typical corpus luteum in some species and its absence in others. In certain viviparous lizards both macroscopic and microscopic evidence of corpora lutea was noted by Hett (1924), Weekes (1934), and Cunningham and Smart (1934). The last-named authors also noted the absence of corpora in oviparous lizards. Clausen (1935) briefly reported important observations on the presence, and on effects of removal (total ovariectomy), of "luteal" bodies in viviparous snakes. Fraenkel and Martins (1938) noted the presence, in pregnant viviparous snakes, of bodies indistinguishable from the corpora lutea of mammals and further showed that these corresponded in number to the ova or embryos present in the oviducts. At this stage in the development of the subject a short abstract of results of the present study was published. (Riddle and Schooley, 1938a).

Further morphological studies on the corpora of viviparous snakes have been made by Rahn (1938; 1939) and Fraenkel and Martins (1939; 1940). Porto (1941) made crude ethanol extracts of such corpora

[1] Received June 24, 1944.

[2] Now director of Endocrine Laboratories, Difco Laboratories, Inc., Detroit, Mich.

and showed that they contained progesterone. It should be noted that Porto's tests were made by *subcutaneous* injection into immature rabbits to which 10 I.U. of estradiol benzoate had been administered daily for eight days. Though relatively large amounts of progesterone are required for detection following subcutaneous injection, an extract from only 2.9 gm of corpora from pregnant snakes was shown to contain progesterone. Slightly preceding this group of studies, McGinty, Anderson, and McCullogh (1938; 1939) developed a highly sensitive method by which as little as 0.25 to 1 μg of crystalline progesterone may be detected. That method made it practicable to carry out the present study, since fowl and pigeon ovaries could be expected to contain only minute amounts of progesterone. In Corner's laboratory Haskins (1939) observed that as little as 0.25 gamma of progesterone, also the amount present in 0.2 cc serum from a pregnant guinea-pig, may be detected by the McGinty test. Later, Haskins (1940) reported important studies in which mitotic counts in the uterine epithelium were utilized to increase the sensitivity of the test, and also to make it usable for the quantitative assay of progesterone.

Besides contributing to our growing knowledge of progesterone production in oviparous and viviparous vertebrates, it was hoped that the results of the present study might incidentally provide information bearing on the role of progesterone in the induction of broodiness in lower vertebrates. Noble, Kumpf, and Billings (1938) noted that progesterone, like prolactin, has the ability to induce broody behavior in normal and castrate jewelfish; and Riddle and Schooley (1938b) observed that some male and female ring doves could be made completely broody within 2 to 5 days by temporary implantation of pellets of progesterone. If bird ovaries were found to contain much progesterone this would provide at least a possibility that this hormone may participate in the onset or regulation of broodiness; if bird ovaries were shown to contain no progesterone any physiologically significant role of this hormone in broodiness would be rendered doubtful or excluded. This question has not been definitely answered, however, by the present study. It has been shown that properly conducted tests on three samples of bird ovaries, all of which were suitable for test (since they contained ovulated follicles in various early stages of regression and a few growing follicles), failed to show the minute amount of progesterone that is detectable by the McGinty test.

MATERIAL

Tests were made on a sample of rat ovaries, a sample of pigeon ovaries, and on two samples of fowl ovaries. Each of the two samples of fowl ovaries, prepared for study of their progesterone content, was derived from three hens belonging to three different breeds (Rhode Island Red, Plymouth Rock, White Rock); in all these breeds the hens are usually capable of becoming broody. These six laying hens, whose egg-laying records were accurately known for the previous five days, were removed from fenced-in "runs" on an adjacent farm to similar "runs" at the laboratory three days before their ovaries were removed; trap-nest records were continued to the time of killing for samples. During this 3-day interval one group of three hens received no treatment except such as was incidentally connected with their change of habitat and food; though these changes usually diminish egg production, laying was not immediately suppressed in either of these three birds and both unovulated follicles and ovulated follicles in various stages of regression were found in each of the three ovaries. Extract *A* was prepared from the ovaries of this group. Two of the three hens of the other group laid irregularly during the total of eight days for which trap-nest records were kept; each of these hens received 1,000 units (3.33 mg) of luteinizing hormone from pregnancy urine daily during the last three days, and although only one of them was definitely known to lay during this period (two eggs were laid outside the trap-nest) rather recently emptied follicles were found at autopsy in all cases. Extract *B* was prepared from the ovaries of this

group. In all cases the walls of all ova (follicles) more than 2 mm diameter were slit open and the yolk contents eliminated from the sample. Thus 16.8 gm of ovarian tissue, including the thick walls of unovulated and of recently ovulated follicles, was the starting point for extract *A*, and 12.1 gm the source of extract *B*. These two samples of ovarian tissue were then subjected to Allen's (1932) method for the preparation and purification of progesterone. Each extract was injected into two rabbits, one of which (lower ones on table 1), however, received more than two-thirds of the preparation. The McGinty method was followed closely with the exception that any progesterone contained in our extracts was not in solution in peanut oil but in unseparated fatty material (soluble in methyl alcohol) from the bird's own ovary. These tests were made during May-June.

The pigeon ovaries selected for extraction and study were obtained within 20 hours after the ovulation of the second ovum of the clutch. This period is practically coincident with the onset of broodiness in pigeons, and the two ovulated follicles had, respectively, undergone 64 and 20 hours of regression.

Most of the rabbits used were of a large breed, New Zealand White. All were less than 2.0 months old when priming with estrone was started.

RESULTS

Table 1 gives details of the dosages used and the results of treatments. The data indicate that the simultaneous presence of some lipoid material other than progesterone—such as is contained in a crude methyl alcohol extract of brain tissue—did not measurably affect the sensitivity of the McGinty test for progesterone. Though the rabbits used gave positive tests with 1 μg progesterone, with or without admixture of the brain extract, two rabbits were wholly negative to extracts (*A* and *B*) from approximately 10 gm of prepared fowl ovary; two other rabbits were wholly negative to slightly less than one-half that quantity of the extracts. A crude extract from only 120 mg of luteinized rat ovary gave a reaction equal to that obtained with 1 or 2 μg of progesterone. The "plus" signs (+ to +++) of the table are not necessarily the same as those of previous workers; they represent degrees of stimulation observed in our tests.

TABLE 1.—DATA RELATING TO TESTS FOR PROGESTERONE IN EXTRACTS OF OVARIES OF FOWL, PIGEONS, AND RATS BY INJECTION INTO UTERI OF IMMATURE RABBITS

Rabbit weight	Material and quantity in cc injected into—				Progestational proliferation	
	Right horn		Left horn		Right	Left
		cc		cc		
963	4 μg progesterone	0.2	Sesame oil	0.2	+++	−
900	Extr. pigeon ovary[1]	0.2	Crude extr. brain[2]	0.2	−	−
1775	Part extract *A*[3]	0.25	2 μg progesterone	0.1	−	++
1695	Part extract *B*[4]	0.2[5]	1 μg progesterone	0.05	− −	+
1075	Remainder extract *A*[3]	0.6	None		−[6]	−
1090	Remainder extract *B*[4]	0.5	None		−[6]	−
1135	1 μg prog. + brain extr.	0.2	1 μg progesterone	0.1	++	+
1760	4 μg. prog.[3] + brain extr.	0.2	4 μg progesterone	0.2	+	+++
1250	1 μg progesterone	0.1	Extr. rat ovary[7]	0.2	++	++

[1] Crude methyl alcohol extract (73 mg) of two pigeon ovaries (1.0 gm).

[2] Similar crude methyl alcohol extract (50 mg) of brain of pigeons.

[3] The smaller dose (0.25 cc) represented 30 percent, and the larger dose (0.6 cc) 70 percent, of the total "progesterone fraction" obtained from 16.8 gm of fowl ovaries.

[4] The smaller dose (0.2 cc) represented 29 percent, and the larger dose (0.5 cc) 71 percent, of the total "progesterone fraction" obtained from 12.1 gm of ovaries from treated fowl.

[5] The isolated loop of the uterus was distended with purulent fluid.

[6] A considerable fraction of this material was lost at injection.

[7] The injected material (not weighed) was a crude, methyl alcohol extract of 120 mg of rat ovary heavily luteinized with a preparation from pregnancy urine.

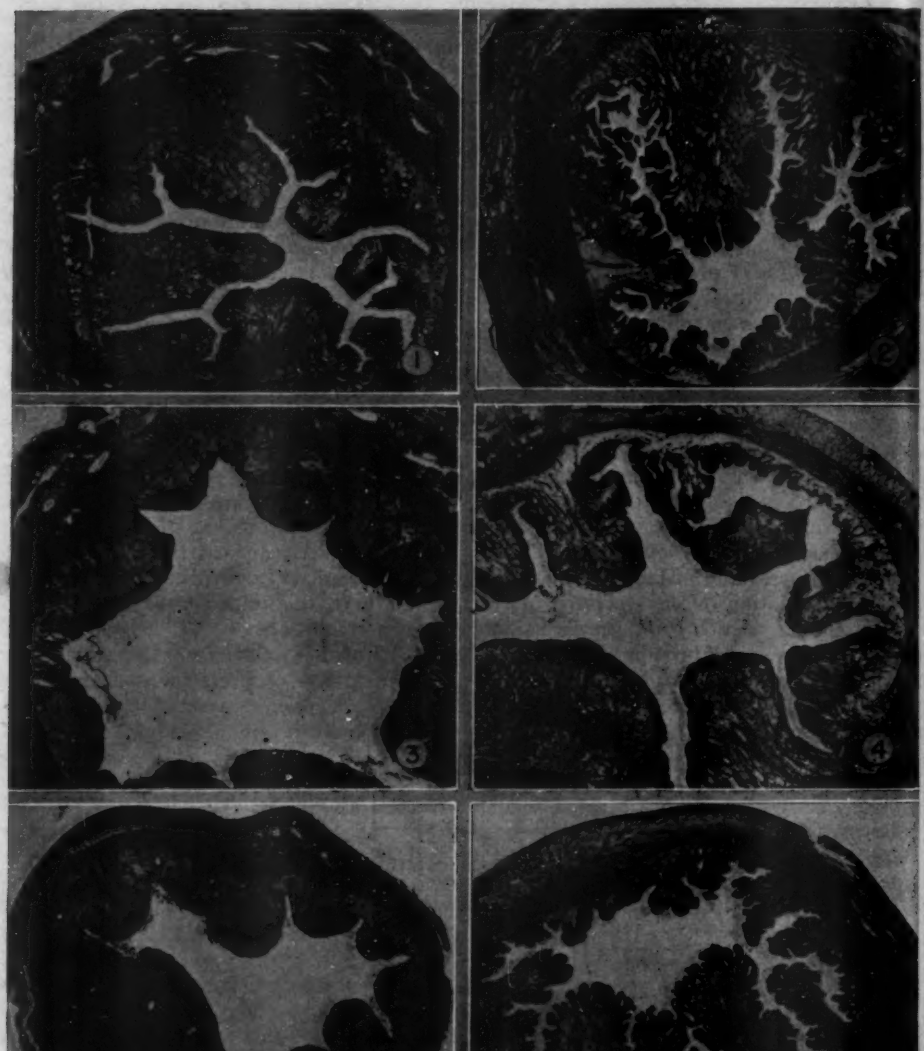

Fig. 1.—Left horn of rabbit uterus (control) injected with 0.2 cc sesame oil. No progestational proliferation. Fig. 2.—Right horn of rabbit uterus injected with 1μg progesterone+brain extract (0.2 cc). Well-marked progestational proliferation. Fig. 3.—Right horn of rabbit uterus injected with extract *A* (0.6 cc) from 11.7 gm fowl ovaries. Distention but no progestational proliferation. Fig. 4.—Right horn of rabbit uterus injected with extract *B* (0.5 cc) from 8.6 gm of ovaries from fowl treated for three days with human pregnancy urine. Distention but no progestational proliferation. Fig. 5.—Right horn of rabbit uterus injected with extract *B* (0.2 cc) from 3.5 gm of ovaries from fowl treated for three days with human pregnancy urine. No progestational proliferation. Fig. 6.—Left horn of rabbit uterus injected with crude extract of 120 mg rat ovary luteinized with human pregnancy urine. Well-marked progestational proliferation.

The condition of several uteri following treatment with extracts of various types of ovaries is shown in Figs. 2–6. A control uterus, injected with sesame oil only (Fig. 1) and three of the uteri treated with extracts *A* and *B* (Figs. 3–5) show no progestational proliferation. A uterus treated with 1 μg progesterone+brain extract (Fig. 2), and another treated with extract of rat ovary (Fig. 6), show such proliferation clearly.

DISCUSSION

The studies of Fraenkel and Martins, and of Porto, seem to have demonstrated that corpora lutea and progesterone (i.e., a substance able to induce progestational proliferation) are produced in some viviparous reptiles. It was thus made evident that vertebrates both lower and higher than birds are capable of producing luteal cells and progesterone. The fact that some *families* of lizards and snakes contain both oviparous and viviparous species—and that the viviparous forms are presumably derived from oviparous ancestors—suggests that a *latent* capacity to produce this hormone may be widespread among exclusively oviparous forms, such as birds. Indeed, it may now be regarded as probable that a wide distribution of that latent capacity was a prerequisite for the origin and success of intrauterine embryonic development in several unrelated genera of reptiles and in (early) mammals. Perhaps only special endocrine and oviducal states or conditions can convert this latent capacity into the actual formation of luteal cells (and of progesterone production in detectable amounts) in oviparous birds, and certainly not all these states or conditions were subjected to test in this investigation. The present study is a contribution to this problem since, for the first time, the ovaries of two oviparous species have been tested for the presence or absence of progesterone. Tests on other species and reproductive states will require several additional investigations. All that is claimed for the present study is that the ovaries utilized by us were shown to contain either no progesterone or an amount which is relatively insignificant in comparison with that found in ovaries of mammals.

The apparent ability of progesterone to induce broodiness in some fishes (Noble, Kumpf, and Billings, 1938) and birds (Riddle and Schooley, 1938b; Riddle and Lahr, 1944), and its similar ability to initiate maternal behavior in rats (Riddle, Lahr, and Bates, 1942), provided a special reason for interest in the outcome of our search for progesterone in the ovaries of fowl and pigeons. If progesterone is a substance directly concerned in the release of broodiness, and not merely one of a variety of substances having ability to cause the pituitary to release the directly effective hormone (Riddle, Lahr, and Bates, 1942), it should be possible to obtain detectable amounts of progesterone from the bird ovary. The absence of such amounts of that hormone in the present tests provides an item of evidence, inconclusive though it is, that progesterone is not directly involved in the initiation of broody behavior.

SUMMARY

The sensitive McGinty test showed that a crude extract of 120 mg of luteinized rat ovary contained more than sufficient progesterone to produce definite progestational proliferation in the uterus of an immature rabbit.

Partly purified extracts from 11.7 gm (also from 5.1 gm) of ovarian tissue from three laying hens, and similar extracts from 8.6 gm (also from 3.5 gm) of ovaries of three such hens treated over three days with 3,000 units of luteinizing hormone from pregnancy urine, did not contain an amount of progesterone detectable by the McGinty test. A test made with a crude extract from two pigeon ovaries (1.0 gm) taken at 20 hours after ovulation of the second egg of the clutch was likewise negative.

Since 0.25 to 1.0 μg of crystalline progesterone, and also the amount of progesterone present in 0.2 cc of serum from a pregnant guinea-pig, are detectable by this method, it is concluded that fowl and pigeon ovaries in the reproductive phases tested by us contain either no progesterone or a relatively insignificant amount in comparison with that found in ovaries of mammals and some viviparous snakes.

It is noted that these results have bearing upon questions involved in the numerous independent origins of viviparity in families of higher vertebrates, and also upon the possibility that progesterone participates in the normal induction of broodiness in birds.

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PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

CHEMICAL SOCIETY

559TH MEETING

The 559th meeting was held in the Auditorium of the Cosmos Club at 8:15 P.M. on Thursday, January 13, 1944. The retiring President, STERLING B. HENDRICKS, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, spoke on *Polymer chemistry of silicates, borates, and phosphates.* This address was published in this JOURNAL **34**(8): 241-251. 1944.

560TH MEETING

The 560th meeting was held in the Auditorium of the Cosmos Club at 8:15 P.M. on Thursday, February 10, 1944. Donald B. Keyes, professor of chemical engineering, University of Illinois, and chief of the Chemical Industries Branch of the Office of Production Research and Development, War Production Board, spoke on *The chemical side of the Davis-Keyes mission to London.*

561ST MEETING

The 561st meeting was held in the Statler Hotel on Thursday, March 9, 1944, at 7:30 P.M. This was the annual dinner meeting of the Society. The Hillebrand Prize for 1943 was awarded to B. H. NICOLET, Bureau of Dairy

Industry, U. S. Department of Agriculture, in recognition of his work on cysteine, threonine, and serine. The speaker of the evening was MILTON HARRIS, of the Textile Foundation. His subject was *Polymer chemistry of wool.*

562D MEETING

The 562d meeting was held in the Auditorium of the Cosmos Club at 8:15 P.M. on Thursday, April 13, 1944. HENRY EYRING, professor of chemistry, Princeton University, spoke on *The effects of pressure, temperature, and certain narcotics on bioluminescence.*

563D MEETING

The 563d meeting was held in the Arts and Science Building of the University of Maryland, College Park, Md., on Thursday, May 11, 1944, at 8:15 P.M. Following a brief, general meeting, divisional programs were presented as follows:

Biochemistry, DEAN BURK, *presiding*

A chemical and physiological study of mimosine, a new alpha-amino acid in Leucaena glauca. RUTH K. YOSHIDA (Bureau of Plant Industry, Soils, and Agricultural Engineering).

The determination of estrone in blood. F. P. VEITCH, JR., and H. S. MALONE (Georgetown University).

On the mode of action of lipooxidase. MARIAN W. KIES (Department of Biochemistry, George Washington University).

Inorganic and analytical chemistry, CHARLES E. WHITE, *presiding*

Low-fluorine calcium phosphates for agricultural uses. W. L. HILL, E. J. FOX, and D. S. REYNOLDS (Bureau of Plant Industry, Soils, and Agricultural Engineering.

The determination of the optical constants of single microscopical crystals. CHARLES P. SAYLOR (National Bureau of Standards).

Visual qualitative analysis with the electric arc. M. J. PETERSON, J. D. RICHARDS, and M. F. SHEFTEL (Bureau of Mines).

Organic chemistry, H. S. ISBELL, *presiding*

The development of indicators for acidity and basicity in hydrocarbons and other oganic solvents. MARION E. MCLEAN (National Bureau of Standards).

The thermal decomposition of acetaldehyde. F. O. RICE and MARY THOMAS MURPHY (Catholic University of America).

Synthesis in the poison-ivy field. HOWARD S. MASON (U. S. Public Health Service).

Physical chemistry, T. I. TAYLOR, *presiding*

The application of the ilkovic equation to quantitative polarography. FLOYD BUCKLEY and JOHN K. TAYLOR (National Bureau of Standards).

Equilibrium constants of some reactions involved in the production of 1, 3-butadiene. F. G. BRICKWEDDE, H. W. WOOLLEY, and M. MOSKOW (National Bureau of Standards).

The thermodynamics and molecular vibration frequencies and internal rotation in propane. KENNETH PITZER.

The separation and recovery of aromatic hydrocarbons from paraffins and naphthenes by adsorption. BEVERIDGE J. MAIR and ALPHONSE FORZIATI (National Bureau of Standards).

Obituaries

GEORGE STEIGER, retired chief chemist of the U. S. Geological Survey, died in Washington, D. C., on April 18, 1944, after an illness of many months. Born in Columbia, Pa., on May 27, 1869, he was brought to Washington in early childhood by his parents. His primary education, obtained in the public schools of this city, was followed by attendance at Columbian College, now George Washington University, where he received the bachelor of science and master of science degrees in 1890 and 1892, respectively. In this latter year he joined the staff of the U. S. Geological Survey as a chemist. His work, in collaboration with and under the guidance of Dr. W. F. Hillebrand, produced a wealth of carefully prepared rock and mineral analyses and did much to standardize analytical procedure in inorganic chemistry. In 1916 he was made Chief Chemist and served in that position until 1930, when, upon his own request, he was relieved of the duties of administration in order to devote full time to research work in spectrography, which he continued until his retirement in 1939.

Until failing health in his later years forced upon him curtailment of physical activity, Steiger had been a devotee of pursuits that brought him in close contact with the woods and waters around Washington. Chief among these was boating. He was the proud owner of a houseboat and several motor-driven boats, which were berthed on the old Chesapeake and Ohio Canal and the Potomac River. A charter member of the Sycamore Island Boat Club, he was ever ready to tell of his experiences in camping and boating along the Potomac and the canal.

Mr. Steiger never married. His life was characterized by a simplicity that resolved itself into a philosophy of kindliness and gentleness, winning for him a host of friends both within and without his profession.

In addition to being a charter member of the Geological Society of Washington, founded in 1892, and a member of the American Chemical Society, for more than 50 years, he was a fellow of the Mineralogical Society of America and the American Association for the Advancement of Science. He was a member of the Washington Academy of Sciences, the American Institute of Mining and Metallurgical Engineers, and the Cosmos Club.

JOSEPH J. FAHEY.

ROGER CLARK WELLS, chief chemist of the U. S. Geological Survey, died unexpectedly on April 19, 1944, only a few hours after the death of George Steiger, retired chief chemist.

Dr. Wells was born at Peterboro, N. Y., on October 24, 1877, son of Byron Wells and Lucy (Clark) Wells. He graduated from Harvard in 1901 and received his doctorate there three years later, working on the atomic weights of sodium and of chlorine, under T. W. Richards. This early training in exact analytical chemistry is reflected in all his later analyses, all done with meticulous attention to accuracy. After holding instructorships at Harvard and Pennsylvania Universities, and serving a year as research chemist with the General Electric Co., he was appointed physical chemist on the Geological Survey in 1908, becoming chief chemist in 1930.

Probably because of his early work on the atomic weight of sodium, he always retained a strong interest in that element and became mineral resources specialist on soda and sodium compounds. Later, with R. E. Stevens, he developed methods for the separation and determination of the rare alkalies.

His contact with the mineralogical work of the Geological Survey evoked a strong interest in the chemical composition of minerals, especially those containing the less common elements, resulting in a number of difficult analyses of minerals of complex composition. The lead-uranium ratio in minerals, as an index of geologic age, fascinated him and for several decades he served on the National Research Council Committee on Measurement of Geologic Time, as well as on several other committees of the Council.

Dr. Wells was a member of many scientific societies, among them the Washington Academy of Sciences in which he served as vice-president in 1923 and 1938. He was president of both the Chemical and Geological Societies of Washington and a member and former elder of the Chevy Chase Presbyterian Church. In 1914 he married Etta May Card, of Syracuse, N. Y., who, with two sons, Arthur Byron and Roger Clark, survives him.

In recent years the administration of an increased chemical force, with urgent war demands for a greatly increased output, placed a heavy burden on Wells. Yet he remained the same kindly, cheerful, and conscientious leader, with no indication to his associates of the strain under which he was working. Ill but a week, his sudden death is a reflection of that strain.

W. T. SCHALLER.

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